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PHYSICS AND MATHEMATICS

No. 30

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1 December 1976

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PHYSICS AND MATHEMATICS

No. 30

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USSR

DAVYDOV, V. N., Moscow State University imeni M. V. Lomonosov

INFLUENCE THAT THE GEOMETRY OF CONSTANT-ENERGY SURFACES HAS ON ANOMALIES OF THE SOUND ABSORPTION FACTOR IN A TYPE $2\frac{1}{2}$ PHASE TRANSITION

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2359-2370
manuscript received 18 Feb 76

[Russian abstract provided by the source]

[Text] An investigation is made of the structure of singularities in the coefficient of absorption of short-wave sound $\delta\Gamma(\omega)$ in the case of a type $2\frac{1}{2}$ phase transition for different constant-energy surface geometry. It is shown that anomalies in Γ depend considerably on the topology of the transition, and in a number of instances can be reduced to anomalies that accompany the appearance (disappearance) of a new cavity or breaking of a bridge of the surface of constant energy. An examination is made of anomalies in the case where a change in topology of the constant-energy surfaces takes place on some locus of singular points in $\mathbf{p}$-space rather than at an isolated singular point $\mathbf{p} = \mathbf{p}_c$. An examination is also made of the influence that the boundaries of the Brillouin zone have on anomalies of the sound absorption factor. References 10 Russian.
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USSR

SHADRICHEV, YE. V., PARFEN'YEVA, L. S., TAMARCHENKO, V. I., GRYAZNOV, O. S., SERGEYEVA, V. M. and SMIRNOV, I. A., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

TRANSFER PHENOMENA AND THE CONDUCTION BAND IN THE SEMICONDUCTOR PHASE OF SmS

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2380-2386
manuscript received 13 Apr 76

[Russian abstract provided by the source]

[Text] The paper gives the results of measurements of electrical and thermal conductivity in the 80-900 K range for two specimens of SmS with different free carrier concentrations. Based on analysis of these results and the data available in the literature on transfer phenomena a scheme is proposed for the conduction band of semiconductor SmS. It is pointed out that acceptance of this scheme means that a re-examination must be made of the present widely accepted view of the the mechanism of phase trnasition in SmS under hydrostatic pressure. References 14: 7 Russian, 7 Western.

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BRATUS', V. YA., ZARITSKIY, I. M., KONCHITS, A. A., PEKAR', G. S., SHANINA, B. D., Institute of Semiconductors, Academy of Sciences UkrSSR, Kiev

SPIN-LATTICE RELAXATION OF CdS:Mn^{2+}

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2311-2318
manuscript received 11 Mar 76

[Russian abstract provided by the source]

[Text] An investigation is made of spin-lattice relaxation [SLR] of Mn^{2+} in single crystals of CdS also doped with (Ag, Cl) and Li. It is found that at 4.2 K recovery after saturation of different transitions of the fine structure shows single-exponent behavior, and SLR time $\tau_1 = 40$-80 ms. The SLR rate is appreciably dependent on the angle θ between axis C of the crystal and the direction of the external magnetic field. The temperature dependence of τ_1^{-1} in the 2-20 K range takes the form $\tau_1^{-1} = AT + BT^5$ when $\theta \approx 0$, and $\tau_1^{-1} = CT + DT^7$ when $\theta \approx 45°$. The SLR rate of Mn^{2+} in CdS is calculated within the theory of relaxation of ions in the Blume-Orbach S-state with consideration of Coulomb interaction with $3d$ electrons in Leushin's sense. It is concluded from analysis of kinetic equations and the angular

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BRATUS', V. YA., ZARITSKIY, I. M., KONCHITS, A. A., PEKAR', G. S. and SHANINA, B. D., FIZIKA TVERDOGO TELA, Vol 18, No 8, Aug 76 pp 2311-2318

dependence of the EPR spectrum that the angular dependence of τ_1 is related to a change of initial conditions for saturation of different transitions. It is established that the nature of relaxation of different transitions is considerably dependent on the ratio α between the probabilities of transitions with dipole (W_1) and with quadrupole (W_2) rules of selection. Estimates are found for the values of $\alpha = W_1/W_2 \approx 0.25$ and $W_2 = 0.2\text{-}0.4\ s^{-1}$. It is shown that the change in temperature dependence of τ_1^{-1} at $\theta = 0°$ and $\theta = 45°$ is due to the difference in the contributions to the SLR rate made at these angles by transitions within the Kramers doublets and between them, which have different temperature dependences of SLR rates in the vicinity of two-phonon processes. References 10: 3 Russian, 7 Western.

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USSR

VIKHNIN, V. S., DEYGIN, M. F., SEMENOV, YU. G. and SHANINA, B. D., Institute of Semiconductors, Academy of Sciences USSR, Kiev

SPIN RELAXATION OF DEEP IMPURITY CENTERS IN EXCHANGE SCATTERING OF CONDUCTION ELECTRONS

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2222-2228 manuscript received 22 Mar 76

[Russian abstract provided by the source]

[Text] An expression is derived for the cross section of exchange scattering of conduction electrons by deep impurity centers in semiconductors that involves a change in spin state. The effective hamiltonian of exchange interaction with the electrons of the deep state is derived. Cases of both inelastic and elastic scattering are examined. An investigation is made of the influence of exchange interaction on displacement of the g-factor, and the possibility of polarization of localized spins is discussed. Scattering of conduction electrons by interstitial Fe and Si atoms is considered by way of an example. The theory shows satisfactory agreement with experiment. References 15: 8 Russian, 7 Western.

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USSR

KASTAL'SKIY, A. A., MAL'TSEV, S. B. and VENGALIS, B. YU., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

PIEZORESISTANCE OF HEAVILY DOPED Si(Li)

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2201-2204 manuscript received 16 Mar 76

[Russian abstract provided by the source]

[Text] The authors have studied the piezoresistance of heavily doped Si(Li) and its change during annealing of specimens at 25 and -10°C. The measurements show development of pronounced spatial nonhomogeneity in the distribution of electrically active Li (and free electrons). An interpretation for this effect is given within the framework of a phase transition model of the "liquid-to-gas" type in the Si(Li) electron-ion sublattice. Estimates from analysis of experimental data show an energy depth of the "condensate" of $\Delta E \approx 0.19$-1.2 eV, and a density of states for Li in Si of $N_c \approx 5 \cdot 10^{22}$ cm^{-3}. References 6: 3 Russian, 3 Western.

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USSR UDC 621.315.592

BURBAYEV, T. M., KURBATOV, V. A. and NENIN, N. A., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, Moscow

DETERMINATION OF DRIFT MOBILITY FROM MEASUREMENTS OF NOISE IN PHOTORESISTORS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 10, No 5, 1976 pp 1008-1010 manuscript received 10 Dec 75

[Abstract] Noises were measured in germanium photoresistors doped with zinc and antimony at liquid nitrogen temperatures. Noise power was determined as a function of electric field under equilibrium conditions for two specimens having different carrier mobilities and lifetimes. Measurements of the frequency dependence of photoresponse showed that lifetimes remain constant in biasing fields up to 400 V/cm. Mobility is also found to be independent of field intensity. Drift mobility is calculated from a formula for the noise power in terms of electric field strength, carrier lifetime and drift mobility. The results agree with measurements of the Hall effect within an error of about 10-15%. References 3: 1 Russian, 2 Western.

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USSR

DUBININ, N. V., BLINOV, L. M., LUTSENKO, E. L. and ROZENSHTEYN, L. D., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

FIELD DEPENDENCES OF ELECTROABSORPTION SPECTRA IN METAL-SEMICONDUCTOR-METAL STRUCTURES

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2387-2390 manuscript received 13 Apr 76

[Russian abstract provided by the source]

[Text] An investigation is made of electroabsorption in a thin-film (10^3 Å) Al—organic semiconductor (fuchsin)—SnO_2 structure. The totality of the experimental data obtained on the first and second harmonics of the modulating field (600 Hz) shows a weakly polar crystallographic film structure, and also the presence of an intrinsic electric field of the barrier near the contact (with height $e\phi_{Al} \leqslant 2$ eV, and width $l_D \leqslant 310$ Å) close to the Al electrode. An electro-optical memory effect is observed that is attributed to the considerable time of relaxation of electric characteristics of the specimen. It is shown that the change in properties of the barrier with a

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DUBININ, N. V., BLINOV, L. M., LUTSENKO, E. L. and ROZENSHTEYN, L. D., FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2387-2390

variation in the fixed bias across the specimen may have a considerable effect both on the magnitude of the electroabsorption signal (second harmonic), and on the shape of the electroabsorption spectra themselves (first harmonic). It is emphasized that in the case of nonhomogeneous electric fields a correct interpretation of electroabsorption spectra is possible only by comparing the field dependences of electroabsorption spectra found on different harmonics of the modulating field. References 5: 4 Russian, 1 Western.

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USSR UDC 621.315.592

PODOL'SKIY, V. V., KARPOVICH, I. A. and ZVONKOV, B. N., Gor'kiy State Physicotechnical Institute affiliated with Gor'kiy State University imeni N. I. Lobachevskiy

HALL MOBILITY OF ELECTRONS IN $CdSnP_2$ SINGLE CRYSTALS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 10, No 5, 1976 pp 1004-1006 manuscript received 4 Dec 75

[Abstract] Hall mobility is investigated in n-type $CdSnP_2$ with different electron concentrations. Single-crystal specimens with tin or indium ohmic contacts were studied by a conventional compensation method on direct current in a magnetic field of $9 \cdot 10^{-4}$ T or less. In undoped specimens, the electron mobility is maximum and temperature-independent at low temperatures. Copper doping reduces electron concentration, and carrier mobility is reduced to about 800 $cm^2/V \cdot s$ as compared with about 1000-1100 for the undoped crystals. The mobility decreases with a reduction in temperature in the doped specimens. The temperature behavior of electron mobility in both cases can be explained by ionized impurity scattering and the increasing contribution of thermal lattice vibrations to the overall scattering of electrons with a rise in temperature. References 13: 6 Russian, 7 Western.

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USSR UDC 621.382.2

RUL', YU. V. and OVEZOV, K., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

PHOTOELECTRIC PROPERTIES OF DIODES BASED ON n-$ZnSiAs_2$

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 10, No 5, 1976 pp 951-957 manuscript received 12 Aug 75

[Russian abstract provided by the source]

[Text] Diode structures are made on the basis of semi-insulating crystals of n-type $ZnSiAs_2$, and their electric and photoelectric properties are studied. The diodes had high resistance ($R_{lim.} \approx 10^9$ Ω) and were photosensitive in the region $h\nu \approx 1.7$-3.3 eV. The amplitude of the saturation photo-emf for Schottky diodes reached 0.35 V, and for fusion diodes -- 0.6 V when the photon energy exceeds the width of the forbidden band. An exponential increase in photoresponse begins when $h\nu \approx 1.74$ eV, which corresponds to the onset of minimum pseudodirect transitions. The photosensitivity of these diodes for $h\nu > E_g$ increases monotonically with increasing photon energy, and when $h\nu$ exceeds 1.80 eV the photosensitivity surpasses that of serially produced silicon photodiodes and heterojunction photocells based on GaAs.

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RUL', YU. V. and OVEZOV, K., FIZIKA I TEKHNIKA POLUPROVODNIKOV, Vol 10, No 5, 1976 pp 951-957

A strong polarization dependence of photoresponse is observed in diodes based on $ZnSiAs_2$. The observed details of the spectra are compared with the available band structure model of the compound and the selection rules for optical transitions. The spectrum and sign of pleochroism of $ZnSiAs_2$ are discussed with respect to measurements of photo-emf. The results show that diodes based on $ZnSiAs_2$ can be used as high-sensitivity photoreceivers in the visible and ultraviolet regions of the spectrum, and also for registration of the position of the plane of polarization and the power of linearly polarized emission in the spectral range of 2-2.5 eV at room temperature. References 14: 9 Russian, 5 Western.

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USSR

UDC 621.315.592

YEREMIN, V. K., KARASEV, A. V., STROKAN, N. B. and TISNEK, N. I., Physico-technical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

RESOLUTION OF SEMICONDUCTOR DETECTORS THAT UTILIZE IMPACT IONIZATION

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 10, No 5, 1976 pp 940-944 manuscript received 28 Nov 75

[Russian abstract provided by the source]

[Text] An analysis is made of the feasibility of using impact ionization to amplify signals in emission detectors. The main emphasis is placed on the resolution of the detectors. It is noted that in contrast to gas proportional detectors, semiconductors have two additional sources of fluctuations: first of all the nonmonopolar nature of ionization due to holes, and secondly the presence of nonhomogeneities in distribution of the electric field as a consequence of dopant concentration relief. The authors determine the sensitivity of the amplitude spectrum to the specific shape of the distribution of mean free paths of the carriers preceding ionization, as well as to the nonhomogeneities of electric field distribution. A region of emission energies is delineated where it is advisable to use impact ionization in spectrometry. References 7: 1 Russian, 6 Western.
1/1

USSR UDC 621.382.3

GARBUZOV, D. Z., MERKULOV, I. A., NOVIKOV, V. A. and FLEYSHER, V. G., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

DIFFUSION OF 'SPIN-TAGGED' ELECTRONS IN A DOUBLE HETEROSTRUCTURE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 10, No 5, 1976 pp 934-939 manuscript received 28 Nov 75

[Abstract] The paper gives the results of an experimental study of diffusion of minority carriers in a heterostructure of p-$Al_xGa_{1-x}As$ under conditions of optical orientation at a temperature of 77 K. Measurements of the polarization and intensity of luminescence of the narrow-band region show spin diffusion into this region. This is confirmed both by the high ratio of polarizations from the narrow-band and wide-band layers, and by the temperature dependence of the corresponding luminescence intensity ratio. It is shown that spin diffusion of oriented electrons persists for a distance of several μm. The Hanle effect is studied as a function of surface layer thickness. The results show that quantitative discrepancies between theory and experiment can be attributed to nonuniform etching. Agreement is satisfactory from the qualitative standpoint. References 6: 5 Russian, 1 Western.
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USSR

KRUPSKIY, I. N., LEONT'YEVA, A. V., INDAN, L. A., and YEVDOKIMOVA, O. V., Physicotechnical Institute of Low Temperatures, Academy of Sciences USSR

ANOMALIES IN THE LOW-TEMPERATURE DUCTILITY OF SOLID HYDROGEN

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 5, Sep 76 pp 297-300 manuscript received 28 Jul 76

[Abstract] The plastic deformation of solid parahydrogen and normal (75% ortho) hydrogen under constant uniaxial tension was tested on perfectly transparent polycrystalline specimens, 30 mm long and 6 mm in diameter, which had been grown from the liquid phase. Above 9K the steady-state creep rate of normal hydrogen was found to follow the trend established by the usual thermal activation mechanism, with U = 200°K corresponding to spontaneous diffusion and with an exponent n = 3.0-3.5 in the power-law relation between strain rate and stress. Within the liquid-helium range of temperatures the strain rate of normal hydrogen was found to be a weak function of the temperature, a linear function at low stress levels. The strain rate here was also found to be very sensitive to the quality of a specimen as well as to the presence of extraneous

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KRUPSKIY, I. N., LEONT'YEVA, A. V., INDAN, L. A., and YEVDOKIMOVA, O. V., PISMA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI Vol 24, No 5, Sep 76 pp 297-300

impurities. In the case of parahydrogen, with a maximum strain rate over 50 times higher than that of normal hydrogen, mass-spectrometric analysis showed a pronounced correlation between the strain rate and the deuterium content. The minimum strain rate of $1.75 \cdot 10^{-7} s^{-1}$ corresponds to a deuterium content of 0.22%. Experiments showed that with this deuterium content the strain rate is almost independent of the temperature in the 2-4.2 K range. No effect of the Peierls potential on the rate of plastic deformation was revealed. The extremely high strain rate in absolutely pure parahydrogen could be a result of dislocations moving either over potential barriers or tunneling coherently through them. Further studies are required to establish exactly which mechanism operates here. References 10: 6 Russian, 4 Western.

USSR UDC 621.315.592

DIDORA, T. D. and NITSOVICH, V. M., Chernovtsy State University

EFFECT OF SCATTERING PROCESSES ON NEGATIVE MAGNETORESISTANCE IN DOPED SEMICONDUCTORS

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian No 7, 1976 pp 62-67 manuscript received 30 Dec 75

[Abstract] In this research an attempt is made to measure magnetoresistance in a narrow energy band in doped semiconductors based on the assumption of reciprocal scattering of electrons with opposite spins. With application of an external magnetic field the electron spins are oriented, resulting in an increase of relaxation time, and accordingly negative magnetoresistance. Scattering processes in this case are of two types: scattering of an electron with spin σ by space and time fluctuations on each atom that has an electron with spin $-\sigma$. The space and time fluctuations are analyzed independently. It is found that as the degree of band filling N increases, the energy dependence of the density of states $\rho_\sigma(E)$ decreases in the lower band and increases for the upper band. The density of states in the lower band as $N \rightarrow 0$

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DIDORA, T. D. and NITSOVICH, V. M., IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA No 7, 1976 pp 62-67

becomes equal to that in the upper band as $N \rightarrow 2$. It is shown that the magnitude of negative magnetoresistance rises with increasing magnetic field, and that the magnitude of magnetoresistance increases with an increase in N and reduction of temperature. References 17: 6 Russian, 11 Western.

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USSR

UDC 548.52

CHERNOV, A. A., TEMKIN, D. YE., and MEL'NIKOVA, A. M., Institute of Crystallography, Academy of Sciences USSR

THE THEORY OF CAPTURE OF SOLID INCLUSIONS UPON GROWTH OF CRYSTALS FROM A MELT

Moscow KRISTALLOGRAFIYA in Russian Vol 21, No 4, Jul/Aug 76 pp 652-660 manuscript received 17 Aug 75

[Russian abstract provided by the source]

[Text] Conditions of crystallization in a thin gap between the leading edge of growth and foreign particles being repulsed by it are studied. The repulsion results from molecular forces in the gap, attraction--from the force which draws the particles along in the viscous melt. The form of the gap is approximately calculated and the critical growth rate V_c, is found beginning with which a spherical particle of radius R will be captured by the growing crystal. For small particles, $R \ll \lambda^2/\ell$, the critical velocity $V_c=(0.14\ B_3/\eta R)\ (\alpha/B_3R)^{1/3}$,

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CHERNOV, A. A., TEMKIN, D. YE., and MEL'NIKOVA, A. M., KRISTALLOGRAFIYA Vol 21, No 4, Jul/Aug 76 pp 652-660

where $\lambda=(\Omega\alpha/\Delta S\mathcal{G})^{1/2}$, $l=(B_3\Omega/\Delta S\mathcal{G})^{1/2}$, Ω is the specific molecular volume in the melt, α is the specific free energy of the crystal-melt interface, η is the viscosity of the melt, B_3 is a constant that defines the reduction in chemical potential in a thin film of melt as compared with the mass of liquid (of the order of 10^{-14} erg or more), and $\mathcal{G}$ is the temperature gradient on the growth front. For large particles $R>\lambda^2/l$, $V_c=0.15\,B_3/\eta Rl$. References 19: 16 Russian, 3 Western.

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USSR UDC 621.039.85

FIKS, V. B., Physicotechnical Institute imeni A. F. Ioffe, Academy of Sciences USSR, Leningrad

THE POSSIBILITY OF STRUCTURAL STUDIES OF CRYSTALS BY INDICATOR COMPONENT NUCLEI

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229 No 1, 1976 pp 80-83
manuscript received 23 Dec 75

[Abstract] A study is made of the conditions which indicator component nuclei must satisfy, the possibilities for structural analysis using i.c.n., the capabilities for detection of atomic nuclear collisions, the frequency of indicator nuclei and possible trends in their search and utilization. Indicator nuclei radiating gamma quanta and indicator nuclei radiating neutrons are analyzed. References 7: 6 Russian, 1 Western.

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USSR UDC 548.737

FILIPENKO, O. S., PONOMAREV, V. I., and ATOVMYAN, L. O., Institute of Chemical Physics, Academy of Sciences USSR, Chernogolovka, Moskovskaya Oblast

CRYSTALLINE AND MOLECULAR STRUCTURE OF TRICLINIC p-NITRO-p'-METHYLBENZYLIDENE ANILINE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 5, 1976 pp 1113-1116 manuscript received 2 Apr 76

[Abstract] Continuing the study of the stimulated emission of a second harmonic of neodymium laser radiation in NMBA powder, X-ray structural analysis of triclinic crystals produced by recrystallization from ethyl alcohol was undertaken. The coordinates of nonhydrogen atoms and their standard deviations are presented in a table, as are the anisotropic thermal parameters and their standard deviations and the coordinates of hydrogen atoms and their standard deviations. Bond lengths and valence angles are presented on a diagram. References 10: 8 Russian, 2 Western.

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USSR UDC 536.12

BENDELIANI, N. A., and ORLOV, M. R., Institute of High Pressure Physics, Academy of Sciences USSR, Akademgorodok, Moskovskaya Oblast

THE SYSTEM CaF_2-ScF_3 AT A PRESSURE OF 100 Kbar AND A TEMPERATURE OF 1200°C

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 5, 1976 pp 1098-1100 manuscript received 9 Feb 76

[Abstract] This work is a continuation of studies of the polymorphism of scandium trifluoride under the influence of high pressures and temperatures. Several comments are made concerning the changes in the phase diagram for the CaF_2-ScF_3 system at normal pressure. The main changes consist in the appearance of an area of a tysonite-like solid solution near pure ScF_3 and a significant increase (by approximately a factor of 5) in the concentration interval of stability of the solid solution based on CaF_2. Both facts indicate a tendency toward increasing similarity in the nature of the phase relationship of CaF_2-ScF_3 with systems consisting of CaF_2 and trifluorides of elements with larger trivalent ions (La and certain other rare earth elements). References 6: 4 Russian, 2 Western.

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USSR UDC 548.4

BONDARENKO, I. YE., YEREMENKO, V. G., and NIKITENKO, V. I., Institute of Solid State Physics, Academy of Sciences USSR, Chernogolovka, Moskovskaya Oblast

ELECTRON MICROSCOPE STUDY OF THE PECULIARITIES OF MOVEMENT OF DISLOCATIONS IN HEAVILY DOPED SILICON CRYSTALS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 5, 1976 pp 1087-1090
manuscript received 18 Dec 75

[Abstract] It is clear that further progress in the understanding of the dynamic properties of dislocations in semiconductors requires detailed information on the condition of the crystal as to point defects near the nucleus of the moving dislocation, its atomic structure. This work presents data important for the problem at hand, produced in a study of deformed silicon single crystals by means of a transmission high resolution electron microscope. The presence of segregations following a moving dislocation can be considered direct proof that the number of impurities on a moving dislocation is significantly greater than their volumetric concentration. The reasons for the development of tracks behind moving dislocations in lightly doped silicon

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crystals is studied. The experiments indicate that dislocations, as they move, capture not only interstitial impurities and vacancies, but also the majority active electrical dopants in the substitution position. References 15: 11 Russian, 4 Western.

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USSR UDC 548.736.6

SHUMYATSKAYA, N. G., VORONKOV, A. A., ILYUKHIN, V. V., and BELOV, N. V., Institute of Crystallography, Academy of Sciences USSR

TUNDRITE, $Na_2Ce_2TiO_2[SiO_4]\ (CO_3)_2$: REFINEMENT OF THE CRYSTALLINE STRUCTURE AND CHEMICAL FORMULA

Moscow KRISTALLOGRAFIYA in Russian Vol 21, No 4, Jul/Aug 76 pp 705-715
manuscript received 13 Jan 76

[Abstract] As a result of refinement of the crystalline structure of tundrite (new X-ray experiments), an altered chemical formula of this mineral is established and tundrite is found to be a representative of a rather rare family of minerals--the silicocarbonates. Structural projections and X-ray diffraction patterns are presented. In spite of indications of qualitative manifestation of a piezo-effect in tundrite crystals, its structure, within the limits of permissible accuracy of X-ray analysis, is described by the centrosymmetrical Fedorov group $P\bar{1}$. Tundrite can now be considered definitely to be a complex alkaline titanium silicocarbonate with rare earth elements (basically cerium) without hydroxyl groups and without neutral water molecules. References 13 Russian.
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USSR UDC 548.732:539.26

DATSENKO, L. I., Institute of Semiconductors, Academy of Sciences UkSSR

VIOLATION OF FRIEDEL'S LAW IN ELASTICALLY DEFORMED CRYSTALS

Moscow KRISTALLOGRAFIYA in Russian Vol 21, No 4, Jul/Aug 76 pp 788-793
manuscript received 11 Apr 75

[Russian abstract provided by the source]

[Text] Based on the Penning-Polder theory, dependences of absorption factor α and migration factor β of normalized intensity I_{R_H} are established for the Lane diffracted beams for hkl and $\overline{hkl}$ reflections as functions of the deformation effectiveness parameter p. Satisfactory agreement is shown between the calculated values of I_{R_H} and the experimental results produced upon investigation of the influence of parameter p fixed by means of the temperature gradient on the Lane diffraction intensities of CuK_α radiation from the (110) plane of silicon without dislocations. The influence of α and β on the deviation from Friedel's law in deformed crystals is studied in the approximation of thick and thin crystals. References 18: 8 Russian, 10 Western.
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USSR

ALEKSEYEV, V. A., OVCHARENKO, V. G., RYZHKOV, YU. F., and SADOVSKIY, M. V., Institute of Nuclear Physics, Moscow State University

EXPERIMENTAL PROOF OF ANDERSON LOCALIZATION IN MOLTEN SELENIUM

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 4, 1976 pp 214-217 manuscript received 5 Jul 76

[Russian abstract provided by the source]

[Text] The conductivity of selenium is measured in the area of high temperatures (around 2000°C) and pressures (up to 1000 atm), significantly greater than the critical temperatures and pressures. A sharp decrease in conductivity of the selenium is observed with a decrease in density after saturation is reached at the level of $2 \cdot 10^2 ohm^{-1} \cdot cm^{-1}$, which, according to the well-known Mott criterion, corresponds to the minimum value of metallic conductivity. This conductivity behavior is a result of Anderson localization of electrons, which is confirmed by the calculations presented. A method is suggested for checking the formula for conductivity near the threshold of mobility and determination of the critical index. References 8: 4 Russian, 4 Western.

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ASTEMIROV, T. A., BAGAYEV, V. S., PADUCHIKH, L. I., and POYARKOV, A. G., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR

SPREADING OF ELECTRON-HOLE DROPS IN Ge

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 4, 1976 pp 225-228 manuscript received 16 Jul 76

[Russian abstract provided by the source]

[Text] Powerful optical excitation at T=2K is used to study spreading of electron-hole drops in Ge. Several dynamic characteristics of this spreading are presented and discussed. The experimental data agree with the theoretical model of drift motion of drops in a stream of nonresonant phonons (L. V. Keldysh, "Pis'ma v ZhETF, Vol 23, p 100, 1976). The constant characterizing the force of the "phonon wind" in Ge is determined. References 5: 3 Russian, 2 Western.

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USSR UDC 621.382.2

MAGDEN, I. N., and SAFONOV, V. A., Scientific Research Institute of Physics, Odessa State University

METHOD OF DETERMINATION OF THE POSITION OF MICROPLASMAS IN HIGH VOLTAGE p-n JUNCTIONS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan/Feb 76 pp 209-210 manuscript received 30 Mar 75

[Abstract] A method is described allowing determination of the precise position of microplasmas in structures with deep p-n junctions. The method is based on observation of changes in the current-voltage characteristics of the microplasma when it is illuminated with a spot of light with small area. To determine the position of the microplasma area, the specimen with p-n junction is placed in a holder allowing the position of the specimen to be reproduced with an accuracy of 0.05 mm. There must be no metallic absorbing coating on the specimen, at least on one side. The section of the current-voltage characteristic with the microplasma is fixed on the oscilloscope screen and the

manipulator used to scan the surface of the specimen with the light spot. The initial diameter of the light probe is 300-400 μm, which is irised to 100 μm to home in on the spot. The method can thus locate microplasmas, determine their order and such basic parameters as the switching voltage and impedance. References 6 Russian.

USSR

UDC 537.523.5:536.244

PUSTOGAROV, A. V., KUROCHKIN, YU. V., MEL'NIKOV, G. N., PEL'TS, B. L., and LOBOVICH, YU. YE.

A PLASMOTRON WITH AN INTERELECTRODE INSERT OF POROUS CERAMIC

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 8 (2), Jun 76 pp 7-9 manuscript received 25 Sep 75

[Russian abstract provided by the source]

[Text] The paper gives the results of an experimental study of a generator with inside diameter of the porous channel of $2 \cdot 10^{-2}$ m, and cathode-to-anode distance of $85 \cdot 10^{-3}$ m. The porous channel was made by sintering aluminum oxide powder with strengthening additives.

The range of measurement of generator parameters: current 30-250 A, voltage across the arc 80-140 V, overall argon flowrate 10^{-2}-$4.5 \cdot 10^{-2}$ kg/s, mass blow-in through the porous wall 3-15 $kg \cdot m^{-2}s^{-1}$. The current-voltage characteristics of the discharge in the investigated flowrate range, beginning with currents of 120-150 A, show rising behavior. An investigation was also made

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USSR

PUSTOGAROV, A. V., KUROCHKIN, YU. V., MEL'NIKOV, G. N., PEL'TS, B. L., and LOBOVICH, YU. YE., IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK No 8 (2), Jun 76 pp 7-9

of the way that the average mass temperature of the gas, the voltage across the arc and the pressure differential at the wall depend on the mass blow-in. References 3: 2 Russian, 1 Western.

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USSR UDC 537.52

BOZHKO, I. V. and MIROSHNICHENKO, A. A.

DETERMINATION OF THE INFLUENCE OF ELECTRODE MATERIAL ON THE POTENTIAL OF ELECTRIC BREAKDOWN OF AIR AT HIGH TEMPERATURES

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 72-76

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G240 by Yu. Levitan]

[Text] The paper gives the results of studies of the influence that the electrode material has on the potential of electrical breakdown of air at high temperatures to determine the feasibility of using molybdenum disilicide ($MoSi_2$) as electrodes at a temperature that is the maximum allowable for this material (~2000°C). Copper, brass and stainless steel (1Kh18N10T) electrodes were studied in the temperature range of 200-450°C, along with $MoSi_2$ electrodes at temperatures up to 1100°C. The resultant experimental temperature dependences of breakdown [field] intensity for the different electrode materials are satisfactorily described by an empirical relation for discharge voltage as a function of the relative density of air and the size of the discharge gap.
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USSR

KARABUT, A. B., KORSHUNOV, V. N., KUROCHKIN, YU. V., PUSTOGAROV, A. V., and SUPRONENKO, M. N.

AN ELECTRIC ARC GENERATOR WITH POROUS COOLING OF THE INTERELECTRODE INSERT WITH POWER CAPACITY 2 MW

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKNICHESKIKH NAUK in Russian No 8 (2), 1976 pp 10-13 manuscript received 16 Oct 76

[Abstract] This work is dedicated to an experimental study of an electric arc generator with porous cooling of the interelectrode insert stabilizing channel. The use of porous cooling allows, due to the injection of gas, for return of a large portion of the heat transferred to the wall by convection and heat conductivity into the main stream. Stable burning of a powerful electric arc in a porous channel at superhigh injection of the working fluid is achieved. Arc power ranges from 100 to 2000 kW with an overall gas flowrate of 0.05-1.0 kg/s. Current-voltage characteristics are given as well as curves for the thermal efficiency and average mass temperature as related to arc power for various mass

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KARABUT, A. B., KORSHUNOV, V. N., KURCHKIN, YU. V., PUSTOGAROV, A. V., and SUPRONENKO, M. N., IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKNICHESKIKH NAUK No 8 (2), 1976 pp 10-13

flowrates of gas injection. It is shown that the thermal efficiency of the generator is 90-95%. The effects of increased voltage in the arc, lack of shunting of the arc to the channel wall, high turbulence of the flow with strong injection allow operating modes of electric arc generators to be achieved with high volt-ampere ratios and high power with limited discharge current, assuring long operating life. References 6 Russian.

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USSR UDC 539.12.04: 666.11

VOROB'YEV, A. A. and FEDOROV, B. V., Tomsk Polytechnical Institute imeni S. M. Kirov

CHARGING OF DIELECTRICS IN A CONDUCTING MEDIUM BY A BEAM OF HIGH-ENERGY ELECTRONS

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian No 7, 1976 pp 135-136

[Abstract] The authors investigated charging of a dielectric in a conducting medium irradiated by external electrons, using as an example aluminum phosphate glasses composed of 0.1 RO · P_2O_5- 0.9 Al_2O_3 · $3P_2O_5$, where RO is an oxide of an alkali-earth element. It is found that bombarding phosphate glass with a system of fast electrons results in charge accumulation regardless of whether the irradiated specimen is in a conducting or nonconducting medium. These results can help to explain charging of rocks in a conducting (moist) medium under the action of cosmic radiation and radioactivity in the depths of the earth. Reference 1 Russian.

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USSR UDC 621.374.2

D'YAKONOV, V. P., Smolensk Affiliate of Moscow Power Engineering Institute

FORMATION OF POWERFUL NANOSECOND PULSES BY AVALANCHE THYRISTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan/Feb 76 pp 102-104
manuscript received 9 Apr 75

[Abstract] A description is presented of devices for the formation of powerful (about 10 kW) nanosecond pulses, using thristors in the avalanche mode, which increases the maximum amplitude of pulses by a factor of about 3-5, speed by 1-2 orders of magnitude, allowing thristors to be used in this mode for the formation of pulses with active durations of 50-100 ns and peak powers of up to 10 kW in simple relaxation circuits. The thristors are used in the avalanche mode with limited space charge region. Circuits are presented which generate pulses of hundreds of volts across a load of some tens of ohms at repetition frequencies of hundreds of Hz. Oscillographic tracings of pulses generated are presented, as well as a schematic diagram of a rectangular pulse shaper with a storage line. References 4 Russian.

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USSR UDC 532.517.4

LIBROVICH, V. B., and LISITSYN, V. M., Institute of Problems in Mechanics, Academy of Sciences USSR, Moscow

INTERACTION OF FLOW PULSATIONS WITH CHEMICAL REACTION OF A TURBULENT FLAME

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 1, 1976 pp 84-87 manuscript received 1 Jul 75

[Abstract] The authors analyze a steady-state, one-dimensional flow of gas, with consideration of the mutual influence of turbulence and combustion, presenting equations for the change in the energy of turbulent motion, heat conductivity of the compressed gas, discontinuity and the equation of state. It is found that an increase in the scale of turbulence and, consequently, temperature pulsations, leads to displacement of the velocity maximum of the reaction into the area of initial temperatures and extension of the reaction zone in comparison to the heating zone. References 6 Russian.

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USSR UDC 532.526.4

KASHINSKIY, O. N., MALKOV, V. A., and MUKHIN, V. A., Institute of Thermal Physics, Siberian Affiliate, Academy of Sciences USSR, Novosibirsk

STUDY OF THE INITIAL STAGE OF SEPARATION OF A BOUNDARY LAYER BY AN ELECTRIC DIFFUSION METHOD

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 8 (2), 1976 pp 29-33 manuscript received 4 Dec 74

[Abstract] The separation of a boundary layer is studied by an electric diffusion method, which has doubtless advantages when tangential stress on the wall is measured. The presence of reverse flow was recorded by a principle suggested by Karabelas and Hanratty. The use of a double electric diffusion enables determination of quantitative characteristics of the tangential stress on the wall in the area of the transient separation of the boundary layer. The coefficient of reverse flow, forward and reverse components of tangential stress at the wall, velocity profiles and some pulsation characteristics of flow are measured in flat exit cones of two different geometries. Reversed

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USSR

KASHINSKIY, O. N., MALKOV, V. A., and MUKHIN, V. A., IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK No 8 (2), 1976 pp 29-33

flows can be significant with values of relative coefficient of friction 0.4-0.5. The reverse flow factor does not correlate with the generally accepted parameters of the boundary layer. References 9: 2 Russian, 7 Western.

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USSR UDC 532.516

ZEL'MAN, M. B., Institute of Theoretical and Applied Mechanics, Siberian Department, Academy of Sciences USSR

CONCERNING THE INFLUENCE OF ONCOMING PERTURBATIONS ON STABILITY OF BOUNDARY LAYER FLOW

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 8, Jun 76 pp 34-40 manuscript received 21 May 75

[Russian abstract provided by the source]

[Text] An induced perturbation field that differs from the proper field may arise in boundary layer flows under the effect of external sources. This field may have an appreciable effect on flow stability even at low intensities. This paper examines the mechanism of parametric interaction of Tolmin-Schlichting waves where the model of the external field is a harmonic wave with amplitude modulation in the direction of flow in accordance with the law $e^{\sigma x}$. The equations for amplitudes are studied for the steady-state spectrum of initial perturbations and with consideration of unsteady evolution of fluctuations. In the first case analytical expressions are found that describe spatial development of waves. The unsteady problem was solved by the Riemann-Green method.
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USSR

ZEL'MAN, M. B., IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK, No 8, Jun 76 pp 34-40

The condition of absolute instability is presented for the case of an unmodulated external wave. The results show the importance of the relation between the Tolmin-Schlichting wave characteristics and the coefficient of parametric coupling β. The coefficients are calculated for the modal mean velocity profile. It was found that a non-zero normal velocity of the perturbation on the layer boundary leads to an abrupt rise in β. Thus the given model shows that the mechanism of parametric interaction of perturbations in the field of an induced wave may have a qualitative effect on flow stability. References 10: 6 Russian, 4 Western.

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USSR UDC 533.6.011

BELOLIPETSKIY, V. M., Institute of Theoretical and Applied Mechanics, Siberian Affiliate, Academy of Sciences USSR, Novosibirsk

A THIN SHOCK LAYER IN THREE-DIMENSIONAL HYPERSONIC FLOW PROBLEMS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 8 (2), 1976 pp 53-57 manuscript received 13 Feb 74

[Abstract] This work studies the propagation of a three-dimensional flow around thin pointed bodies by a hypersonic stream of nonviscuous, nonheat-conducting gas. On the assumption that the thickness of the perturbed area is slight and the stream lines on the surface are nearly geodesics, an approximate solution is constructed which refines the theory of Newton. In the initial approximation, the desired parameters, with the exception of the circumferential component of velocity, are determined in a plane tangential to the geodesic and perpendicular to the surface of the body based on an approximate solution of the two-dimensional problem. An international method is used to produce an approximation for the distribution of pressure. Examples of calculations of flow around a cone at an angle of attack are presented. References 5 Russian.

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USSR

UDC 532.5.01:536.25(06)

STEPANOV, G. YU.

ALL-UNION SCIENTIFIC SYMPOSIUM ON BOUNDARY LAYER THEORY

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 179-182

[Abstract] The first All-Union Scientific Symposium on Boundary Layer Theory was held 23 through 26 December 1975 at Leningrad Polytechnical Institute. Over 300 representatives of 70 scientific, educational and industrial organizations attended. All sessions of the symposium began with summary reports, the titles of which were: The problem of the separation of a laminar boundary layer; The method of asymptotic expansions in the theory of the laminar boundary layer; Turbulent flow of a gas when dispersed impurities and chemical reactions are present; The laminar boundary layer in chemically reacting multicomponent gas mixtures; The turbulent boundary layer in multicomponent chemically reacting gas mixtures; The contemporary state and problems of unsteady boundary layers; The boundary layer in a gas flow when relaxation processes are present;

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STEPANOV, G. YU., IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA No 4, 1976 pp 179-182

Numerical methods of boundary layer theory; Study of turbulent discontinuous flows; Numerical methods of studying a turbulent boundary layer.

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USSR UDC 533.6.011.55

DAN'KOV, B. N., and PANKOVA, T. S., Moscow

STUDY OF PECULIARITIES OF FLOW AROUND A CONE WITH A LARGE VERTEX ANGLE AT AN ANGLE OF ATTACK

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 160-163 manuscript received 23 Oct 75

[Abstract] Results are presented from experimental studies of the nature of flow around a cone with a large vertex angle in a wind tunnel at supersonic incidnet stream velocities. The study of this problem has been given great attention in recent times. This work expands the concept of the peculiarities of flow around this body at large angles of attack. The studies were performed at angles of attack of 0 to 38 degrees, Mach number 5.93 and Reynolds number $2.3 \cdot 10^6$ (using the diameter of the midsection of the model as a characteristic dimension). The model studied was a blunt cone with a semivertex angle of 70°, blunting radius 0.91 D/2 and sharp corner edges. The spectra of flow around the model, distribution of pressure and nature of dissipation of the

visualizing composition over the lateral surface were studied. In summing up the results of the studies, the authors note that it is the development of areas of flow redistribution and subsequent stagnation which most completely appears at angles of attack greater than -15° which prevents the extension of earlier methods to the case of large angles of attack. References 3: 2 Russian, 1 Western.

USSR UDC 532.516

SIMUNI, L. M., Leningrad

NUMERICAL STUDY OF THE PHENOMENON OF "BLOCKING" UPON FLOW OF A STRATIFIED FLUID AROUND AN OBSTACLE

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 151-153 manuscript received 9 Sep 75

[Abstract] A study is made of the phenomenon of "blocking" with laminar flow of a viscous incompressible fluid around periodically placed obstacles. The nature of motion is traced under conditions of stable temperature stratification. Planar, nonisothermal flow around obstacles is analyzed. It is assumed that the obstacles are rectangular in shape and that the flow rate of the fluid through any vertical cross section is fixed, while the upper surface is either a plane moving with an assigned velocity or an arch surface fixed in space. The problem is studied as a function of the Grashof and Reynolds numbers. The Prandtl number is assumed equal to one. Calculations were also performed for the case when the temperature step is constant and equal to the temperature of the lower surface. In this case, the recirculation zone is smaller than in the case of the zone produced with variable temperature of the projection. References 4: 1 Russian, 3 Western.
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USSR UDC 532-528

AMROMIN, E. L., and IVANOV, A. N., Leningrad

AXISYMMETRIC CAVITATION FLOW AROUND A BODY IN A PIPE

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 50-55 manuscript received 4 Jun 75

[Abstract] The problem of axisymmetric flow around a body in a circular pipe with arbitrary meridional cross section is reduced to numerical solution of a system of two integral equations for determination of the shape of the cavity and intensity of vortex rings located on the solid boundaries and the boundary of the cavity. Results are presented from calculations of cavitation flow around a sphere, elipsoid of revolution and cone in a cylindrical pipe, and for a cone also in conical constricting and expanding pipes and in a shock tube with realistic shape of exit cone and working section. The flow is studied in the mode of fully developed cavitation. The liquid is considered ideal, weightless and incompressible, the flow is considered stable and vortex-free. The pressure within the cavity is assumed constant, its boundary is assumed impermeable, that is the flow moves around it as around the body of a solid. References 5: 4 Russian, 1 Western.
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USSR UDC 532.526.4

VOLCHKOV, E. P., and NIKITIN, P. V., Novosibirsk

TURBULENT BOUNDARY LAYER WITH POSITIVE PRESSURE GRADIENT ON A PERMEABLE SURFACE UNDER NONISOTHERMAL CONDITIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 43-49 manuscript received 7 Oct 75

[Abstract] An approximate theoretical analysis is presented of heat exchange in a turbulent boundary layer of a nonisothermal stream with positive pressure gradient. Experimental results are presented. The experimental study was performed in a combustible graphite diffuser both with and without injection of an inert gas through the wall. It is shown that in streams with positive pressure gradient, the influence of variations from isothermal conditions on heat and mass exchange is less than with zero-gradient flow around a surface. The influence of injection under these conditions can be calculated if the value of the critical parameter of permeability is determined considering the pressure gradient. References 9: 6 Russian, 3 Western.

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USSR UDC 532.517.4

DOKUCHAYEV, O. N., Leningrad

PULSATIONS OF PRESSURE ON A WALL DETERMINED BY THE INTERACTION OF AVERAGE SHEAR WITH PULSATION MOTION IN A TURBULENT BOUNDARY LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian No 4, 1976 pp 28-34 manuscript received 29 Aug 75

[Russian abstract provided by the source]

[Text] The reciprocal spectrum of pressure pulsation power on a wall and the derivative of the component of pulsation velocity perpendicular to the wall in the direction of the longitudinal coordinate is measured; this spectrum determines the mean shear and the contribution of the interaction of average shear with turbulence in pressure pulsations on the wall beneath a turbulent boundary layer. The spectrum is used to calculate the spectrum of power and the transverse reciprocal spectrum of pressure pulsation power on the wall. Comparison of calculated and measured pressure spectra shows that the pulsations of pressure on the wall are almost completely determined by the interaction of average shear with turbulence. References 7: 1 Russian, 1 Polish, 5 Western.

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USSR UDC 532.51

BOGOMOLOV, V. A., Kaliningrad

MOVEMENT OF AN IDEAL FLUID OF CONSTANT DENSITY WHEN SINKS ARE PRESENT

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 4, 1976 pp 21-27 manuscript received 9 Oct 75

[Abstract] A study is made of the unstable motion of an ideal fluid with constant density in an unlimited volume, when the divergence of velocity is other than zero and the density of sinks is assigned dependent on coordinate r and time t. The purpose of the present work is to study the basic regularities of the motion of the system of sources and sinks, both point and distributed types, for subsequent application of the results to the modeling of thermal convection in a flat horizontal layer of liquid, for example periodic convective cells. Primary attention is given to the study of the asymptotic behavior of the density of sinks as time approaches ∞. Conservation laws are derived and discussed for a system of N point sinks. The qualitative behavior of the system is investigated for large elapsed times. An evolutionary equation for the

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USSR

BOGOMOLOV, V. A., IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA ZHIDKOSTI I GAZA No 4, 1976 pp 21-27

density of sinks is produced with arbitrary initial distribution of velocity divergence. The evolutionary equation is solved exactly in the case of finite integral intensity of the density of sinks in an infinite volume assuming cylindrically symmetric initial distribution. The asymptotic behavior of the exact solution of this equation is studied as time approaches ∞ in three qualitatively different cases. References 8: 7 Russian, 1 Western.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

AKIMOV, A. P., GOLUBEVA, N. S., ROZHDESTVIN, V. N. and SOZINOV, B. L.

PHASE AFC IN AUTONOMOUS SINGLE-MODE LASERS

Moscow TRUDY MOSKOVSKOGO VYSSHEGO TEKHNICHESKOGO UCHILISHCHA IMENI N. E. BAUMANA [Works of the Moscow Higher Technical School imeni N. E. Bauman] in Russian No 199, 1974 pp 90-96

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1271]

[Text] The authors examine different circuits for phase AFC in two lasers using transformation of the spectrum of frequency fluctuations of the lasers to the radio band. They demonstrate (1) that by the use of the described systems it is possible to accomplish phase AFC of the frequencies of two and more lasers with an accuracy up to a constant phase difference; (2) that the phase difference in the emissions may be reduced to zero in the steady-state mode with fairly wide original mismatch; and (3) that the time required by the system to act on perturbations when piezoceramic transducers are used as the actuating element may be reduced to 50 ns.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

HARRIS, N. W., O'NEILL, F. and WHITNEY, W. T.

WIDE-BAND INTERFEROMETRIC TUNING OF A MULTIATMOSPHERE CO_2 LASER

OPTICAL COMMUNICATIONS in English, Vol 16, No 1, 1976 pp 57-62

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1270 by V. N. Smirnov]

[Text] The authors investigate tuning of the emission wavelength of a CO_2 laser by varying the angle of inclination of the Fabry-Perot etalons to the cavity axis. In the experiments they used a laser with transverse discharge, controlled by an electron beam, with a pressure of the mixture of 15 atm. For tuning the laser from the region of 9.4 to the region of 10.4 um they placed a cell filled with SF_6, CF_3I or BCl_3 gas in the resonator. Rough tuning in the range of bands of 9.4 or 10.4 um was accomplished with the aid of one Fabry-Perot etalon, and fine tuning and narrowing of the generation lines were achieved using the other Fabry-Perot etalon. They produced pulses of emission with a half-width of 100 ns with an energy of 0.1 J in the range of emission frequency tuning of 70 cm^{-1} with a line width of about 0.03 cm^{-1}.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

BURUNOV, YE. A., MALYSHEV, G. M., RAZDOBARIN, G. T., SEMENOV, V. V. and FOLOMKIN, I. P., Physicotechnical Institute, Academy of Sciences USSR

CHANGE IN THE SCATTERING SPECTRUM OF LASER EMISSION IN PLASMA WITH TRANSITION FROM SPONTANEOUS TO STIMULATED MANDELSTAM-BRILLOUIN SCATTERING (SMBS)

Leningrad IZMENENIYE SPEKTRA RASSEYANIYA LAZERNOGO IZLUCHENIYA V PLAZME PRI PEREKHODE OT SPONTANNOGO K VYNUZHDENNOMU RASSEYANIYU MANDEL'SHTAMA-BRILLYUENA (VRMB) in Russian Preprint No 498, 1975, 9 pp, mimeo.

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1244 by K.O.I.]

[Text] The authors experimentally investigated the change in the radiation spectrum of a ruby laser scattered by a laser spark in air at power densities near the threshold for the SMBS process. They established that with a small surpassing of the SMBS threshold in the long-wave part of the spectrum of the scattered radiation an additional maximum appears whose width indicates a weak damping of stimulated ion-acoustic oscillations of the plasma. When the threshold power has been exceeded significantly the increase in intensity of scattered radiation in comparison with the level of scattering by thermal oscillations comprises a value of 15-20%.
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USSR UDC 535.33:621.375.8;535:530.182;778.38

THE ILA-120 IONIZED ARGON LASER

Moscow NAUCH-NYYE PRIBORY [Scientific Instruments, Collection of Works] in Russian No 8, 1975 pp 98-99

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1195 by K. O. I.]

[Text] This article describes a continuous argon laser (ILA-120) generating in the blue-green band of the spectrum. The laser may operate on 6 fixed lines (457.9, 476.5, 488.0, 501.7 and 514.5 nm) and in the mode of generation of several lines. The maximum output power is 2 W with an angular divergence of 0.5 mrad. The ILA-120 instrument is designed for operation under laboratory conditions and may be used for optical pumping of dye lasers, microtreatment of materials, in holography, in systems of optical information processing and in Raman spectroscopy.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

ALEKSANDROV, V. V., BOGDANETS, A. D., BORZENKO, V. L., BURDONSKIY, I. N., VELIKHOV, YE. P., GENDEL', YU. G., KOVAL'SKIY, N. G., NIKOLAYEVSKIY, V. G., PASHININ, P. P., PERGAMENT, M. I., PONOMAREV, V. G., PROKHOROV, A. M., SELEZNEVA, L. F., SOLOV'YEVA, V. G., SUKHAREV, YE. M., CHERNYAK, V. M. and YAROSH, A. M.

A MONOPULSE LASER WITH EMISSION ENERGY OF 1-3 kF FOR THERMONUCLEAR RESEARCH

Leningrad DOKLADY VSESOYUZNOGO SOVESHCHANIYA PO INZHENERNYM PROBLEMAM UPRAVLYAYEMOGO YADERNOGO SINTEZA [Reports of the All-Union Conference on Engineering Problems of Controlled Thermonuclear Fusion] in Russian Vol 2, 1975 pp 178-183

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1237 by K. O. I.]

[Text] The authors describe and give the parameters of emission from a powerful laser installation on neodymium glass, designed for investigation of the mechanisms of interaction of optical emission with superdense high-temperature plasma, and also the processes of implosion and heating of targets with plane geometry. The master laser, built on the base of a 4-lamp illuminator, ensures

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ALEKSANDROV, V. V., BOGDANETS, A. D., et al, DOKLADY VSESOYUZNOGO SOVESHCHANIYA PO INZHENERNYM PROBLEMAM UPRAVLYAYEMOGO YADERNOGO SINTEZ Vol 2, 1975 pp 178-183

generation of a monopulse with a duration of 30-50 nsec and an energy of 0.1 J with diffraction divergence. A special device for shaping the pulse, consisting of two cable oscillators, switchable dischargers with laser ignition, two Pockels cells, charging cables and a matching unit, shapes a 4-step pulse with variable parameters. The shaped pulse of the master laser arrives at the input of the amplifier system through the system of optical decoupling; the amplifier system consists of a 3-pass telescopic amplifier, one-channel and three-channel amplifiers and elements for separation and shaping of the laser beam. The described system is designed for a pulse energy of up to 1-3 kJ.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

GOLUBEVA, N. S., ZAGIDULLIN, R. SH., KOROSTELEV, V. A. and IKRYANNIKOV, V. I.

ANALYSIS OF PROCESSES IN A SOLID-STATE LASER WITH HARMONIC-LAW VARIATION IN LOSSES

Moscow TRUDY MOSKOVSKOGO VYSSHEGO TEKHNICHESKOGO UCHILISHCHA IMENI N. E. BAUMANA [Works of Moscow Higher Technical School imeni N. E. Bauman] in Russian No 199, 1974 pp 83-86

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1157 by V. Kh.]

[Text] Using an analog computer the authors investigated equations of balance, which describe stimulated emission in a solid-state laser with seni-wave Q-switching. They analyzed the solutions for a modulation frequency slightly smaller than the frequency of the natural peak repetition rate. They established that a clearly expressed capture band exists as a function of the modulation amplitude, beyond the range of which the sequence of peaks has an irregular character, and inside which one observes a tendency to frequency division.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

GOLUBEVA, N. S., KRINITSYNA, L. F., SOZINOV, B. L. and TKACH, N. A.

INFLUENCE OF NONUNIFORM INVERSE POPULATION ON AMPLIFICATION IN A TRAVELING WAVE LASER

Moscow TRUDY MOSKOVSKOGO VYSSHEGO TEKHNICHESKOGO UCHILISHCHA IMENI N. E. BAUMANA [Works of Moscow Higher Technical School imeni N. E. Bauman] in Russian No 199, 1974 pp 73-78

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1152 by V. Kh.]

[Text] The authors obtain a closed system of truncated equations, which describe the process of amplification of a traveling wave by a system of two-level atoms. They take into account the distributions of the coefficient of amplification and light energy across the beam. They study the dependences of the phase and amplitude distortions on the shift in signal frequency relative to the center of the atomic line and shape of the wave front (they examined plane and spherical fronts).

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USSR UDC 535.33:621.375.8;535:530.182;778.38

MIROLYUBOV, R. K., Editing staff of "Tzvestiya VUZov. Fizika"

PRIMARY CRITERIA FOR DECREASING THE DIVERGENCE d_5 OF A QUASIPARALLEL MONOCHROMATIC (LASER) BEAM

Tomsk PERVICHNYYE KRITERII UMEN'SHENIYA RASKHODIMOSTI d_5 KVAZIPARALLEL'NOGO MONOKHROMATICHESKOGO (LAZERNOGO) PUCHKA in Russian 1976 22 pp (Manuscript deposited in the All-Union Institute of Scientific and Technical Information, 23 Feb 76, No 569-76 Dep)

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1273 DEP]

[Text] The author demonstrates that by using a cylindrical lens it is possible to decrease the divergence of a laser beam coming from glass to air at a large angle of refraction (85°).

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USSR UDC 535.33:621.375.8;535:530.182;778.38

GOLUBEVA, N. S., KRINITSYNA, L. F., SOZINOV, B. L., TKACH, N. A.

LASER WITH COMPOSITE ROD

Moscow TRUDY MOSKOVSKOGO VYSSHEGO TEKHNICHESKOGO UCHILISHCHA IMENI N. E. BAUMANA [Works of Moscow Higher Technical School imeni N. E. Bauman] in Russian No 199, 1974 pp 86-90

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1287 by V. N. SH.]

[Text] The authors study the thermal deformations and axial temperature gradient in an active laser element which is a set of discs of Nd-glass with a diameter of 1.5 m [sic] and a thickness of 0.26 cm. On the basis of the computations they demonstrate that the limiting repetition rate of pumping pulses, determined by the temperature gradient on the axis and surface of the rod, in this case comprises 27 Hz. The difference in optical paths arising as a consequence of the nonuniform distribution of temperature over the cross section of the disc, leads to the onset of a heat lens with an effective focal length of

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GOLUBEVA, N. S., KRINITSYNA, L. F., SOZINOV, B. L., TKACH, N. A., TRUDY MOSKOVSKOGO VYSSHEGO TEKHNICHESKOGO UCHILISHCHA IMENI N. E. BAUMANA No 199, 1974 pp 86-90

$30.1 \cdot 10^3$ cm for a repetition rate of 27 Hz. They conclude that the use of a composite rod permits significantly increasing the limiting repetition rate of pumping pulses.

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USSR UDC 535.33:621.375.8;535.530.182;778.38

SKLYAROV, I. K.

NANOSECOND SOURCE FOR PUMPING SEMICONDUCTOR LASERS

PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, 1976 pp 135-136

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1301 by the author]

[Text] The author describes a device for pumping semiconductor lasers by pulses with a duration of 1 ns with an amplitude of about 2 A and recurrence rate up to 5 MHz. He gives the basic circuit and drawing of the construction of the output stage.

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USSR UDC 535.33:621.375.8;535.530.182;778.38

VERZHBOLOVICH, N. A., SAVCHENKO, V. D. and LITVINENKO, A. YA.

THYRISTOR CONVERTER FOR A POWERFUL ARGON LASER

PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, 1976 pp 137-139

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1302 by the authors]

[Text] The authors describe a thyristor converter--an asymmetric three-phase variable bridge designed for regulating and stabilizing the assigned discharge current. The variable element is a thyristor with variable conduction angle. The control circuit ensures opening of the thyristors in the range from 0° to 180° and current stabilization in the range from 40° to 130°. The maximal load current is 450 A.

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USSR UDC 535.33:621.375.8;535.530.182;778.38

COHERENT-OPTICAL DOPPLER DEVICES IN A HYDROAERODYNAMIC EXPERIMENT. A COLLECTION OF SCIENTIFIC PAPERS

Novosibirsk KOGERENTNO-OPTICHESKIYE COPLEROVSKIYE USTROYSTVA V GIDROAERODINAMICHESKOM EKSPERIMENTE. SBORNIK NAUCHNYKH STATEY in Russian, Siberian Department of the Academy of Sciences USSR. Institute of Automation and Electrometry, 1974 264 pp

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D 1322 K]

[Text] This collection is devoted to questions of the theory and application of laser Doppler velocity gauges (LDVG). Studies are made of the design principles of the optical and electronic circuits of the LDVG. Evaluations are given of the potential accuracy of the LDVG and ways are demonstrated for its increase. The advantages of the LDVG are mentioned over other similar type gauges. Practical circuits of laser Doppler velocity gauges are described and the results of several hydrodynamic experiments are cited which demonstrate the broad possibilities of these instruments. The collection is designed for specialists in the field of laser measuring technology and experimental aerohydromechanics.
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USSR UDC 621[378.325+453]

BUNKIN, F. V., and PROKHOROV, A. M., Physics Institute, imeni P. N. Lebedev, Academy of Sciences USSR

USE OF A LASER ENERGY SOURCE FOR THE CREATION OF REACTION THRUST

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 119, No 3, Jul 76 pp 425-446

[Russian abstract provided by the source]

[Text] The physical principles of laser reaction engines are presented, that is reaction engines in which the source of energy ("fuel") is a laser source of electromagnetic energy, located outside the flight vehicle being accelerated. Two mechanisms of creation of thrust are studied--the evaporative mechanism, arising upon evaporation of the working fluid in the spacecraft under the influence of the laser radiation striking it, and the "explosive" mechanism, arising as a result of laser breakdown of air ("explosion") and excitation in it of a shock wave, which acts to put pressure on the flight vehicle. The former mechanism of thrust can be used both in the atmosphere and in space, the latter--only in the atmosphere--laser jet engine. The basic characteristics of laser reaction engines are presented (valve of thrust, specific thrust, thrust efficiency), some of which have been confirmed experimentally. The
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BUNKIN, F. V., and PROKHOROV, A. M., USPEKHI FIZICHESKIKH NAUK Vol 119, No 3, Jul 76 pp 425-446

outlook for the use of lasers is emphasized. References 26: 18 Russian, 8 Western.

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USSR UDC 536.73+621.378.3

KONYUKHOV, V. K., PROKHOROV, A. M., Physics Institute, imeni P. N. Lebedev, Academy of Sciences USSR

THE SECOND LAW OF THERMODYNAMICS AND LASERS WITH THERMAL EXCITATION

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 119, No 3, Jul 76 pp 541-550

[Abstract] A review is presented of the first works formulating the idea of direct transformation of thermal energy to coherent electromagnetic radiation using lasers. It is shown that the operation of a gas dynamic CO_2 laser can be described on the basis of the second law of thermodynamics. References 12: 9 Russian, 3 Western.

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USSR UDC 621.378.32

MILINKEVICH, A. V., SAVVA, V. A., and SAMSON, A. M.

HIGH FREQUENCY SELF-MODULATED RADIATION OF LASERS WITH INERTIAL FEEDBACK

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 25, No 1, Jul 76 pp 43-51 manuscript received 30 Mar 76

[Russian abstract provided by the source]

[Text] The inertia of feedback in lasers exists due to the finite time required for radiation to pass through the resonator. It is particularly manifested when losses or amplification of the laser change significantly during the time T of passage. In these cases, a mono-pulse appears at the output, modulated with "period" T. A detailed description is presented of how a nonhomogeneity arises in the distribution of radiation density through the resonator and is converted to a pulse traveling between the mirrors, causing modulation of the output radiation. In a standing wave laser, in contrast to a

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MILINKEVICH, A. V., SAVVA, V. A., and SAMSON, A. M., ZHURNAL PRIKLADNOY SPEKTROSKOPII Vol 25, No 1, Jul 76 pp 43-51

unidirectional ring laser, not one, but two pulses can arise per passage. Their relative amplitudes and durations depend on the parameters and position in the resonator of the active substance and modulator. With slow (in comparison with T) Q-switching and saturation of the gain, an unmodulated, smooth monopulse is produced, described by the conventional theory (a laser with noninertial feedback). References 23: 13 Russian, 10 Western.

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USSR UDC 621.378.32

AFANAS'YEV, A. A., VLASOV, R. A., and ZHVAVYY, S. P.

DEFORMATION OF A POWERFUL LASER PULSE UPON DEVELOPMENT OF AVALANCHE IONIZATION IN A GAS

Minsk ZHURNAL PRIKADNOY SPEKTROSKOPII in Russian Vol 25, No 1, Jul 76 pp 154-156 manuscript received 15 Jul 75

[Abstract] A study is made of the reduction in duration of a powerful laser pulse due to the development of avalanche ionization in an atomic gas. The possibility is demonstrated of controlling the duration of the radiation pulse by changing the gas pressure. It is suggested that the phenomenon of nonlinear absorption of radiation with optical breakdown be used to produce short light pulses with a steep trailing edge. References 6: 4 Russian, 2 Western.

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USSR

UDC 533.92:621.039.61

BEDILOV, M. R., TSOY, T. G., and EGAMOV, U.

EMISSION OF CHARGED PARTICLES FROM THE BACK SIDE OF A TARGET UPON INTERACTION WITH LASER RADIATION

Moscow IZVESTIYA AKADEMII NAUK SSSR SERIYA FIZICHESKAYA in Russian Vol 40 No 8, 1976 pp 1741-1744

[Abstract] The first work by the authors on the emission of charged particles from the back side of a target upon interaction of the target with laser radiation shows that the emission generally consists of two peaks (a fast peak and a slow peak) and that their nature was not fully clear. In order to further clarify problems related to the emission of charged particles from the back side of a target, the authors performed a series of experiments using a ruby laser with maximum power density up to $10^{11} W \cdot cm^{-2}$, aluminum and tungsten foil targets 50 to 200 μm thick for aluminum, 20 to 100 μm thick for tungsten in a vacuum chamber. The nature of the first peak, which is delayed about 30 ms and varies from 150 ms to 350 ms in duration, and is not influenced by the potential between the target and the grid, indicates that it is a field of

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BEDILOV, M. R., TSOY, T. G., and EGAMOV, U., IZVESTIYA AKADEMII NAUK SSSR SERIYA FIZICHESKAYA Vol 40 No 8, 1976 pp 1741-1744

charges or at least of particles with very high energies. The second peak expands and increases in amplitude, approaching the first peak, quite natural since its formation involves not only thermal particles flying away from the back side of the target, but also particles arising on the frontal side and flying through the apertude formed. References 5: 3 Russian, 2 Western.

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USSR UDC 621.373.5

SKLYAROV, O. K., Central Scientific Research Institute of Communications, Moscow

A NANOSECOND SOURCE FOR PUMPING OF SEMICONDUCTOR LASERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan/Feb 76 pp 135-136
manuscript received 22 Apr 75

[Abstract] A device is suggested for pumping of semiconductor lasers with pulses 1 ns in duration and about 2 A in amplitude with a repetition frequency of up to 5 MHz. The source suggested for pumping of semiconductor lasers with dual heterostructure is simple and compact and consists of two amplifier-shaper channels operating into a common semiconductor laser load. The output stage of each channel consists of two parallel type KT911B transistors. The source has been tested with a semiconductor laser with a threshold current of 800 mA. Pulses with amplitude of 1 V and duration of 10 ns were fed to the input at a repetition frequency of 100 KHz-5MHz. The electrical pulses across the terminals of the laser and a test resistor were recorded by an oscillograph. The coherent mode developed at currents of 1.2-1.5 A and was recorded

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SKLYAROV, O. K., PRIBORY I TEKHNIKA EKSPERIMENTA No 1, Jan/Feb 76 pp 135-136

by its diffraction pattern using an image converter.

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USSR

UDC 621.375.846.038.823

VERZHBOLOVICH, N. A., SAVCHENKO, V. D., and LITVINENKO, A. YA., Institute of Physics, Siberian Affiliate Academy of Sciences USSR

A THYRISTOR CONVERTER FOR A POWERFUL ARGON LASER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan/Feb 76 pp 137-139
manuscript received 9 Mar 75

[Abstract] A description is presented of a thyristor converter--an unbalanced three-phase controlled bridge, designed for regulation and stabilization of an assigned discharge current. The regulating element is a thyristor with controlled conduction angle. The control circuit provides for opening of thyristors in the 0-180° range and stabilization of current in the 40-130° range. Maximum load current is 450 A. The converter consists of two main units--the three-phase bridge controlled rectifier and the control unit, consisting of three identical channels constructed on the "vertical" principle. Particular attention is given to phase symmetry of the channels provided by a stabilized constant supply voltage for all phases and synchronization of each channel

with the circuit by a three-phase synchronizing transformer. The converter has been used to excite discharges in an Ar laser with an optical radiation power of about 3 W. The usual initial current fluctuations during the first few minutes of discharge were not observed. References 3: 2 Russian, 1 Western.

USSR UDC 621.375.826

KOCHUBEY, S. A., LISITSYN, V. N., LUNIN, V. M., CHAPOVSKIY, P. I., Institute of Semiconductor Physics, Siberian Affiliate, Academy of Sciences USSR, Novosibirsk

A HIGH TEMPERATURE LASER CELL WITH TRANSVERSE DISCHARGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 76 pp 163-164
manuscript received 24 Apr 75

[Abstract] The design is described of a laser cell with a transverse discharge, in which a single-turn transformer is used. The cell produces generation on nitrogen (wavelength 3371 Å). The design suggested allows the use of transverse excitation of active media with high operating temperatures, for example metal vapors. The unit can be made using easily available materials. The maximum temperature which can be maintained by the cell is determined by the melting point of the dielectric cylinder and the metal turns of the transformer. It is suggested that high temperature ceramics and refractory metals be used to extend the range of temperatures at which the laser cell can operate. References 2 Russian.

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USSR UDC 621.375.826

GALOCHKIN, V. T., ZAVOROTNYY, S. I., KOSINOV, V. N., and OVCHINNIKOV, A. A., Institute of Physics, Academy of Sciences USSR, Moscow

A CO_2 PULSE LASER WITH TRANSVERSE DISCHARGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 76 pp 161-163
manuscript received 3 Jun 75

[Abstract] The design of a pulsed CO_2 laser excited by a transverse electric discharge with variable emission pulse duration is described. The energy output of the laser is 22.5 J/"liter," the maximum output energy 18 J. Emission pulses can be varied from 4 μs to 40 μs in duration changing the composition of the mixture and the density of the resonator. Frequency selection is achieved by the use of an equilateral prism of NaCl or a diffraction grating with 100 lines per millimeter. When a flat resonator is used, the divergence is $4\text{-}6 \cdot 10^{-3}$ rad. It is estimated that the use of an internal resonator and an output mirror with a more resistant coating could result in energy outputs of up to 30 J/"liter." Reference 1 Russian.

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USSR UDC 533.95:537.84

BORBLIK, YE. L., BUTOVSKIY, L. S., ZHOLUDOV, YA. S., LYUBCHIK, G. N., NEKHAMIN, M. M. and CHMEL', V. N.

INVESTIGATION OF THE COMBUSTION CHAMBER OF AN EXPERIMENTAL MHD GENERATOR AND SOME PROBLEMS OF UPDATING

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 25-36

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G328 by Ye. P. Potanin]

[Text] The paper presents data of an experimental study of a pilot MHD generator with straight-flow combustion chamber. An analysis of the results of tests of a modified version of the plasma generator showed that one way to improve the system is to use a bluff body (pylon) as a fuel-feeding and stabilizing element. It is noted that future work on updtaing the combustion chamber should be directed toward reducing the intensity of fluctuations in parameters.

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USSR UDC 533.95:537.84

DRAYTSUN, I. A.

ANALYTICAL EXAMINATION OF ELECTROMAGNETIC FIELDS IN A CHANNEL WITH AN ESTIMATE OF THE ERROR OF THE SOLUTION

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 109-116

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G327 by Ye. P. Potanin]

[Text] The paper gives the analytical calculation of the electromagnetic field in a channel based on examination of a singly connected region z with an outline L that has n corner points z_k. It is noted that the resultant solution in explicit form is exact and enables one to find the distribution of the electromagnetic field at the corner points of the region.

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USSR UDC 533.95:537.84

FRANTSEVICH, I. N., NAYDICH, YU. V., GNESIN, G. G., STRASHANIN, E. P., KONDRATSKIY, V. A., KOROL', D. I., LESOVOY, N. V. and MAZUR, N. I.

DEVELOPMENT OF SEALED SILICON-CARBIDE ELECTRODES FOR A STATIONARY OPEN-CYCLE MHD GENERATOR

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 49-52

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G326 by Yu. P. Potanin]

[Text] The paper gives the results of experimental tests of sealed SiC electrodes for a stationary open-cycle MHD generator. The base design was a "mosaic" electrode of polycrystal SiC (size in the plan view 115 x 220 mm) made up of 36 elements (cross section 20 x 20 mm) joined by Pb-Ti solder to the surrounding water-cooled copper current lead. No erosion or thermomechanical damage was noted after repeated operation of the electrodes.

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USSR UDC 533.95:537.84

FEDORENKO, V. A., SAMSONIK, V. A. and DEBCHINSKAYA, S. N.

INVESTIGATION OF THE CHARACTERISTICS OF A MAGNETODYNAMIC PUMP OPERATING WITH BITHYRISTOR DRIVE

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 130-141

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G325 by Ye. P. Potanin]

[Text] A theoretical analysis is done on the operation of an MHD pump with bithyristor drive. It is shown that if the inductors in the pump are fed from a source of sinusoidal voltage and if the current in the channel is also sinusoidal, while the electromagnet is connected to the thyristor regulator that distorts the shape of the output voltage, the average electromagnetic force is determined only by the first harmonic of magnetic induction and by the angle of phase displacement $\phi = \psi_i - \psi_{B1}$. In the case where both the inductors and electromagnet are connected to the source of supply, using thyristor regulators with diodes connected in opposed parallel, the average force is the algebraic sum of the components formed by the interaction of

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FEDORENKO, V. A., SAMSONIK, V. A. and DEBCHINSKAYA, S. N., VOPROSY MGD-PREOBRAZOVANIYA ENERGII, No 2, "Naukova dumka," 1975 pp 130-141

identically numbered harmonics of the current and the magnetic induction. It is noted that the calculations did not account for the reaction of the armature current and for certain peculiarities of thyristor operation in the case of a resistive-inductive load. However, the results enable development of requirements that must be met by the thyristorized voltage regulator.

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USSR UDC 533.95:537.84

BOBKOV, A. A., KOVALEV, V. N. and LARIONOV, YU. A.

CONCERNING THE INFLUENCE THAT THE EXCESS OXIDANT RATIO HAS ON THE ELECTRICAL CHARACTERISTICS OF AN MHD GENERATOR

TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 13, No 6, 1975 pp 1314-1316

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G324 by Ye. P. Potanin]

[Text] The paper gives the results of an experimental study of the way that the short-circuit current of a Faraday MHD generator depends on the excess oxidant ratio α with and without additive. The combustion-chamber plasma source was equipped with an augur burner and operated on a mixture of oxygen gas and kerosene; the additive was an aqueous solution of potash. In the absence of an additive, a constant rise was observed in the short-circuit current with decreasing α for each pair of electrodes. With an additive present, the maximum short-circuit currents were in the range of $\alpha = 0.8$-0.9. Visual examination of the MHD generator channel after the experiment showed that soot precipitation was intensive on channel walls with temperature below 600°C, and was insignificant where wall temperature was beyond 900°C.
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USSR UDC 533.95:537.84

APUKHOVSKIY, A. I.

LIMITING THE PULSATION LEVEL IN THE OUTPUT CIRCUITS OF DC MHD GENERATORS

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 43-49

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G323 by Ye. P. Potanin]

[Text] The paper discusses methods of limiting the level of pulsations of voltage and current in the output circuits of MHD generators by using smoothing systems. Several types of such devices are examined. It is shown that when pulsations of appreciable amplitude are present in the output voltage of a DC MHD generator, it is most feasible to use passive smoothing devices with diode elements in the output circuits of these generators. The installation of such systems will not only ensure the level of pulsations in the load required by the GOST [All-Union State Standards], but surplus power delivery as well, increasing generator efficiency.

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USSR UDC 533.95:537.84

ZHOLUDOV, YA. S. and STRASHININ, E. P.

ANALYSIS OF THE POSSIBLE LEVEL OF FORCING OF THE MAGNETIC SYSTEM OF AN EXPERIMENTAL MHD GENERATOR

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 37-42

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G322 by Ye. P. Potanin]

[Text] Unsteady heat exchange in the cooled conductor is calculated as applied to the magnetic system of an experimental MHD generator, and numerical estimates are presented for a number of specific cases. As a result of analysis, temperature distributions in the cooling water are found with respect to time and with respect to the conductor channel. It is noted that with current forcing up to $I = 1.6I_{nom.}$ theoretical and experimental data are comparable: the permissible duration of this mode may exceed 10 minutes (for initial temperature of the cooling water $t_0 = 10\text{-}20°C$, $t_{safe} = 100°C$, $v \geqslant 1$ m/s). Double current overload may also be permitted over a useful experimental time period.

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USSR UDC 533.95:537.84

DEDKOV, A. N.

ON SOLUTION OF THE VARIATIONAL PROBLEM OF THE MAXIMUM USEFUL POWER OF AN MHD GENERATOR

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 3-9

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G321 by Ye. P. Potanin]

[Text] It is shown that solution of the variational problem of maximum energy takeoff from the core of the flow in MHD generators gives the optimum relation between gasdynamic and electrical parameters on the boundary between the core and the viscous zone. Taken as the viscous wall region is the zone corresponding to the displacement thickness σ^*. The region outside this zone is treated as the inviscid, thermally nonconductive two-dimensional core of the flow. It is assumed that the two-dimensionality of the core is due to the geometric effect of the profiling walls on the flow and cross sectional nonhomogeneity of electromagnetic quantities.

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USSR UDC 533.95:537.84

METELYUK, S. A. and REPA, I. I.

CONTROL OF OPERATING CONDITIONS IN MHD DEVICES WITH A COMBUSTION CHAMBER

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 15-25

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G320 by Ye. P. Potanin]

[Text] Working expressions are found for determining the consumption of the main components of the initial plasma materials of combustion products in MHD devices. The paper gives the results of calculation for a number of specific operating modes; use of these data enables determination of the weight proportions of fuel, ionized additive, main and supplementary oxidizers in the case where the fuel is natural (Dashevsk) gas, the additive is a water-alcohol solution of KOH of K_2CO_3, the main oxidizer is air, and the supplementary oxidizer is pure oxygen.

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USSR UDC 533.95:537.84

GANEFEL'D, R. V., PANASEVICH, L. L., RED'KIN, V. B.

ON PULSATIONS OF THE LOAD FACTOR AND SPECIFIC POWER IN OPEN-CYCLE MHD GENERATORS

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 10-15

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G319 by Ye. P. Potanin]

[Text] It is shown that changing the Hall connection of electrodes in an MHD generator to a circuit with diagonally conductive walls appreciably reduces the level of pulsations in the electric power output. Based on analysis of an idealized model of an MHD generator it is established that the reason for this effect might be a change in the load factor and its pulsations for operation on a single load with different circuits. The dependence of the level of pulsations in the load factor on pulsations of plasma temperature is determined.

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USSR UDC 533.95:537.84

KAZAKEVICH, O. YA.

ELECTRODE PHENOMENA AND A JET MODEL OF SINGLE-ENDED MICRO-ARCS ON COOLED ELECTRODES IN A PLASMA FLOW

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 63-71

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G318 by Ye. P. Potanin]

[Text] An investigation is made of electrode phenomena in a stream of high-temperature plasma in the channel of an MHD generator that are associated with the presence of a cold boundary layer and low electrical conductivity. A jet model is proposed for description of single-ended micro-arcs formed in the electrode layer at the cathode. The plasma flow from the zone of constriction at the cathode spot is treated as a free turbulent gas jet with rectilinear boundaries. The energy balance is set up by setting the Joule heat equal to the heat of losses due to convection, radiation and heat conductivity lengthwise of the arc. The shape of the jet axis is calculated for thicknesses of the dynamic boundary layer of $\sigma = 3.4 \cdot 10^{-3}$ m and

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KAZAKEVICH, O. YA., VOPROSY MGD-PREOBRAZOVANIYA ENERGII, No 2, "Naukova dumka," 1975 pp 63-71

$\sigma = 10^{-2}$ m. The theoretical and experimental results show satisfactory agreement for $\sigma = 3.4 \cdot 10^{-3}$ m. The author discusses the nature of displacement of micro-arcs on electrodes in an applied transverse magnetic field.

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USSR UDC 533.95:537.84

MAZUR, N. I. and DRAYTSUN, I. A.

EXACT CALCULATION OF ELECTROMAGNETIC FIELDS IN MULTIPLY CONNECTED REGIONS OF COMPLEX CONFIGURATION WITH CORNER POINTS

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 103-109

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G317 by Ye. P. Potanin]

[Text] Electromagnetic fields in multiply connected regions with complex configuration and corner points are calculated as applied to investigation of electromagnetic phenomena in the channel of an MHD generator. The results give an exact solution of the two-dimensional problem of finding the electromagnetic field for many magnetic systems without predetermination of the magnetic force line pattern. It is noted that the proposed method is convenient for calculating electromagnetic fields in the channel of MHD devices with consideration of the electrode phenomena that take place at corner points of the region.

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USSR UDC 533.95:537.84

KAPUSTYANENKO, G. G.

TWO-DIMENSIONAL MODEL STUDY OF THE PROCESS OF COMPRESSED LIQUID OR GAS CONTAINMENT IN CROSSED FIELDS BY USING A LAYER OF ELECTRICALLY CONDUCTIVE FLUID

Kiev VOPROSY MGD-PREOBRAZOVANIYA ENERGII [Problems of MHD Energy Conversion, Collection of Works] in Russian No 2, "Naukova dumka," 1975 pp 116-125

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G316 by Ye. P. Potanin]

[Text] The problem of stability of the interface between electrically conductive and nonconductive fluids is examined on the example of a two-dimensional model problem within the framework of the energy method as applied to a synchronous MHD generator on piston flow of incompressible liquid. The results are compared with data of a model experiment on a flat chamber with transparent walls enabling visualization of the process on the interface. The data of the experiment agree with the theoretical results.

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USSR UDC 533.92:621.039:61

PANKRAT'YEV, YU. A., NABOKA, V. A., VDOVIN, S. A., LAVRENT'YEV, O. A. and KALMYKOV, A. A.

PLASMA ACCUMULATION AND CONTAINMENT IN ELECTROMAGNETIC TRAPS

Khar'kov VOPROSY ATOMNOY NAUKI I TEKHNIKI. SERIYA FIZIKI PLAZMY I PROBLEM UPRAVLYAYEMYKH TERMOYADERNYKH REAKTSIY [Problems of Nuclear Science and Technology. Series on Plasma Physics and Problems of Controlled Thermonuclear Reactions, Collection of Works] in Russian No 1(3), 1975 pp 4-21

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G109 (résumé)]

[Text] The paper presents the results of investigations of the processes that accompany accumulation, containment and collapse of a plasma in electromagnetic traps. The plasma was created by ionization of a neutral gas by an electron beam injected via an axial slit in the trap. The conditions of plasma formation and containment were varied over wide limits: magnetic field up to 0.65 T, energy of injected electrons up to 3 keV and gas pressure 10^{-4}-10^{-8} mm Hg. Methods are found for suppressing long-wave diocotron instability, and conditions are determined for accumulation of a plasma in the trap with density of $\sim 10^{12}$ cm^{-3}, electron temperature of about 1000 eV and ion temperature around 300 eV. Lifetime of plasma particles -- 3-5 ms.
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USSR UDC 533.9.01+533.92:621.039.61

MASALOV, V. L., PARFENOV, O. G., and SHISHKO, A. A., Siberian Institute of Terrestrial Magnetism, the Ionosphere and Propagation of Radio Waves, Siberian Department, Academy of Sciences USSR, Irkutsk

THE PROPAGATION OF HEAT IN A RAREFIED PLASMA ACROSS A MAGNETIC FIELD

DOKLADY AKADEMII NAUK SSSR in Russian Vol 229 No 5, 1976 pp 1091-1094 manuscript received 5 Mar 76

[Abstract] This work is dedicated to the study of the pertubation of the thermal wave of a magnetic field due to an electric current caused by the thermal emf as heat is transferred across a magnetic field in θ-pinch devices. Results are presented from a self-similar approach for computer modeling of MHD pulse processes and experimental data, indicating that under certain conditions the thermal emf may be responsible for the appearance of compression of the magnetic field near a powerful source of heat. The appearance of a magnetothermal wave may cause, in a rarefied plasma, an increased heat transfer across the magnetic field due to excitation of small scale turbulence by the electric current and the related increase in collision frequency. References 10: 9 Russian, 1 Western.
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USSR UDC 533.92:621.039:61

PEREPELKIN, N. F., SHVETS, O. M., VASIL'YEV, M. P., DIKIY, A. G. and KULAGA, A. YE.

HIGH-FREQUENCY PLASMA TURBULENCE IN THE 'URAGAN' STELLARATOR WITH ION-CYCLOTRON PUMPING

Khar'kov VOPROSY ATOMNOY NAUKI I TEKHNIKI. SERIYA FIZIKI PLAZMY I PROBLEM UPRAVLYAYEMYKH TERMOYADERNYKH REAKTSIY [Problems of Nuclear Science and Technology. Series on Plasma Physics and Problems of Controlled Thermonuclear Reactions, Collection of Works] in Russian No 1(3), 1975 pp 29-37

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G125 (résumé)]

[Text] The spectrum of microinstabilities is studied under conditions of strong ionic nonisothermicity accompanying ion-cyclotron heating of the plasma in the "Uragan" stellarator. Intense epiterhmal noises are observed close to frequencies of the lower hybrid resonance $\omega \sim \omega_L$ and $\omega \sim 2\omega_L$. Analysis shows that under the conditions of the experiments where the transverse current velocity of electrons did not exceed the thermal velocity of ions $\frac{u}{V_{T_i}} \leq 1$ and $\frac{T_e}{T_i} \ll 1$, the effective ion heating could be attributed to

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PEREPELKIN, N. F. et al., VOPROSY ATOMNOY NAUKI I TEKHNIKA. SERIYA FIZIKI PLAZMY I PROBLEM UPRAVLYAYEMYKH TERMOYADERNYKH REAKTSIY, No 1(3), 1975 pp 29-37

excitation of a high-frequency electronic-acoustic instability. Long-wave noises in the plasma with $\lambda_L^{\parallel} \gg \lambda_{se}^{\parallel} = (T_i m_e)^{1/2} \omega_{pi}^{-1}$ and $\lambda_L^{\perp} \gg \lambda_{se}^{\perp} \sim \frac{V_{T_i}}{\omega_{pi}}$ are in their turn the product of transformation of short-wave electronic sound in the ionically hot plasma.

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USSR

AMBARTSUMYAN, R. V., GOROKHOV, YU. A., MAKAROV, G. N., PURETSKIY, A. A., and FURZIKOV, N. P., Institute of Spectroscopy, Academy of Sciences USSR

DISSOCIATION OF ISOLATED MOLECULES IN A MATRIX BY INFRARED RADIATION

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 5, Sep 76 pp 287-289 manuscript received 20 Jul 76

[Abstract] Selective dissociation of isolated molecules in a low-temperature matrix by high-power infrared laser radiation has been noted for the first time in the case of SF_6 molecules on a CsI substrate. Mixtures of SF_6-Ar (1:1250) and SF_6-CO (1:500) were deposited on a CsI substrate, the latter being cooled with a helium crystal down to 8-10 K. These specimens were then irradiated with a CO_2 laser at atmospheric pressure, on frequencies of 942.4 or 940.5 cm^{-1} at variable intensity (5-30 MW/cm^2), and a pulse duration of 90 ns. It was found that isotopically selective dissociation of SF_6 takes place under laser emission, the products of dissociation becoming enriched with ^{32}S and the SF_6 remaining in the matrix becoming enriched with ^{34}S. With a higher degree of dissociation, the peak of $^{32}SF_6$ absorption shifts toward lower laser frequencies.

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USSR

AMBARTSUMYAN, R. V., GOROKHOV, YU. A., MAKAROV, G. N., PURETSKIY, A. A., and FURZIKOV, N. P., PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI Vol 24, No 5, Sep 76 pp 287-289

After further irradiation, the matrix eventually blackens and finally breaks down. References 3: 1 Russian, 2 Western.

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USSR

KARLOV, N. V., PETROV, R. P., PETROV, YU. M., and PROKHOROV, A. M., Institute of Physics, imeni P. N. Lebedev Academy of Sciences USSR

SELECTIVE EVAPORATION OF FROZEN GASES BY LASER RADIATION

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 5, Sep 76 pp 289-292 manuscript received 20 Jul 76

[Abstract] Gaseous BCl_3 containing its natural isotopes was frozen and deposited as a thin film on a substrate held at the temperature of liquid nitrogen and transparent to infrared radiation. Subsequent irradiation with a CW CO_2 laser resonant to the ν_3 vibration of $^{11}BCl_3$ molecules leads to preferential evaporation of $^{11}BCl_3$ molecules when exposure is of relatively short duration and low intensity. The film became gradually enriched with $^{10}BCl_3$ molecules with an increase in the number of exposures to pulses of 1-3 min duration and 1 W/cm^2 intensity. The selectivity of decreases with heating of the film. This is reflected in the trends of the relative enrichment factor ($^{11}BCl_3/^{10}BCl_3$ after irradiation divided by $^{11}BCl_3/^{10}BCl_3$ in the original gaseous phase) as a function of the irradiation intensity and as a function of the irradiation time. References 4 Russian.

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USSR UDC 535.338.41

ALIYEV, M. R., Institute of Spectroscopy, Academy of Sciences USSR

FORBIDDEN ROTATIONAL TRANSITIONS IN MOLECULES

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 119 No 3, Jul 76 pp 557-572

[Russian abstract provided by the source]

[Text] A state-of-the-art survey of theoretical and experimental research on forbidden rotational transitions in polar and nonpolar molecules, begun essentially in 1971. Three mechanisms are studied for the appearance of forbidden rotational transitions: 1) centrifugal distortion; 2) an harmonic potential energy; 3) vibronic interaction (the Jahn-Teller effect). The method of calculation of the effective dipole moment and strength of transitions based on successive contact transformations of the Hamiltonian and the dipole moment operator is presented, formulas are presented for the line strengths of the most important classes of molecules, the results of experimental investigations of centrifugal transitions of molecules of tetrahedral hydrides by the methods

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USSR

ALIYEV, M. R., USPEKHI FIZICHESKIKH NAUK Vol 119 No 3, Jul 76 pp 557-572

of double resonance and microwave and infrared spectroscopy are noted. Particular attention is given to vibronic transitions, which have not yet been detected. An approximate estimate of the dipole moment of such transitions in triply degenerate electron states of molecules is presented for the first time, and it is shown that the strength of the transitions may be of the same order of magnitude as an harmonic and centrifugal transitions. References 68: 13 Russian, 55 Western.

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USSR UDC 621.039.5

TRUBNIKOV, V. P., ATROSHENKO, E. I., NESTERENKO, V. B., KOVALEV, S. D. and SUKHOTIN, A. M.

PARTICULARS OF THE TECHNOLOGY OF CHEMICALLY REACTING COOLANTS: PROBLEMS OF CORROSION AND CLEANING. GENERALIZED EXPERIENCE OF STAND OPERATION

Obninsk SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH [Current State and Prospects of Research on Developing Nuclear Electric Power Plants with Fast Reactors, Collection of Works] in Russian Vol 2, 1975 pp 355-360

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V797 by V. Sh. Sulaberidze]

[Text] An examination is made of dissociating nitrogen dioxide as the coolant and working gas in nuclear power reactors. N_2O_4 is a chemically active gas. Corrosion studies revealed a long list of construction materials that are resistant to the coolant over a wide range of temperatures and pressures. Typical materials are stainless steels of the austenite, martensite and ferrite classes and a number of nickel-base alloys. In the temperature range of 350-700°C at a pressure of 20-50 atmospheres, the rate

of corrosion of stainless steels is 0.0003-0.0015 $g/m^2 \cdot hr$. When the pressure is increased to 150 absolute atmospheres, there is no appreciable change in the nature of corrosion, and the corrosion rate remains within acceptable limits. An increase of temperature in the 350-700°C range reduces corrosion. At temperatures of 20-200°C, stainless steels corrode with weight loss, the corrosion rate increases with temperature, and at 100°C lies within limits of 0.001-0.003 $g/m^2 \cdot hr$. The rate of corrosion of titanium and its alloys is lower than that of stainless steels. At low temperatures and pressures, aluminum and its alloys have high corrosion resistance. In the overwhelming majority of cases the corrosion rate of construction materials in the low temperature region increases if water gets into the nitrogen dioxide. The resultant nitric acid can be removed from the coolant in the rectification process. The permissible content of nitric acid is 0.2-0.5%. Nitrogen dioxide undergoes radiolysis under the influence of ionizing emission from the reactor. At temperatures above 500°C, irreversible thermal dissociation becomes noticeable. The products of radiolysis and thermal dissociation are nitrogen, oxygen and nitrous oxide. Dissociation products are removed by scavenging part of the steam in the condenser. Nitrogen oxides are toxic.

USSR

TRUBNIKOV, V. P. et al., SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH, Vol 2, 1975 pp 355-360

The limiting permissible concentration of nitrogen oxide vapors in the air of work rooms is 5 mg/m^3, and in the air of populated areas -- 0.085 mg/m^3. At the Institute of Nuclear Physics of the Academy of Sciences of the BSSR, about 30 experimental stands have been set up and have been in operation up to the present without accidents. Experience has shown that the stands operate normally when the optimum coolant composition is maintained and a constant watch is kept on impurities.

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USSR UDC 621.039.5

STRIMISKA, Frantishek, LOKHMAN, Karel, BUKHNICHKOVA, Zdenka

EXPERIMENTAL STUDY OF THE ZONE OF HEAT EXCHANGE DETERIORATION IN SODIUM STEAM GENERATORS

Obninsk SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH [Current State and Prospects of Research on Developing Nuclear Electric Power Plants with Fast Reactors, Collection of Works] in Russian Vol 2, 1975 pp 146-166

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V791 by S. A. Markin]

[Text] A brief description is given of the physical model of the boiling crisis in a two-phase heat-transfer agent. A detailed description is given of an experimental two-loop sodium-water heat exchanger, along with the measurement technique and equipment complex. It is noted that the design of the experimental heat exchanger permits generalization of the study results to a straight-flow model steam generator designed for the BOR-60 installation. The paper gives the results of the first stage of studies of heat exchange deterioration in the evaporative part of the experimental

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USSR

STRIMISKA, F., LOKHMAN, K. and BUKHNICHKOVA, Z., SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH, Vol 2, 1975 pp 146-166

heat exchanger. It is noted that the point of onset of the boiling crisis and the corresponding limiting vapor content depend on the mass flowrate and are practically independent of the heat flux. At the same time, the paper gives the results of tests of an isolated module of a straight-flow steam generator. Agreement is noted between the results found on the module, and the experimental heat exchanger. A program for future research is briefly outlined.

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USSR UDC 621.039.5

SUBBOTIN, V. I., USHAKOV, P. A., ZHUKOV, A. V., MATYUKHIN, N. M., YUR'YEV, YU. S. and KUDRYAVTSEVA, L. K.

HEAT EXCHANGE IN THE CORES AND SHIELDS OF FAST REACTORS

Obninsk SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH [Current State and Prospects of Research on Developing Nuclear Electric Power Plants with Fast Reactors, Collection of Works] in Russian Vol 2, 1975 pp 5-47

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V790 by S. A. Markin]

[Text] The paper summarizes the results of theoretical and model studies by the authors on heat exchange in hexagonal fuel elements of fast reactors. Basic characteristics are presented for fuel assemblies for the BOR-60, BN-350 and BN-600 reactors, which are the main object of the research, and the geometric characteristics of the corresponding experimental models are given. The basic principles of the thermal modeling are outlined. Relations are derived for the Nusselt numbers in laminar and turbulent flow conditions, and formulas are presented for calculating the distribution of temperatures

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SUBBOTIN, V. I., USHAKOV, P. A., ZHUKOV, A. V., MATYUKHIN, N. M., YUR'YEV, YU. S. and KUDRYAVTSEVA, L. K., SOSTOYANIYE I PERSPEKTIVY RABOT PO SOZDANIYU AES S REAKTORAMI NA BYSTRYKH NEYTRONAKH, Vol 2, 1975 pp 5-47

in the fuel elements and coolant. Separate consideration is given to heat exchange in the peripheral channels and an investigation is made of the influence that the diameter of displacers has on the temperature fields in the fuel elements. An analysis is made of the influence of different factors (deviation of geometric dimensions, different types of spacing of the fuel elements, the presence of interchannel mixing and so forth) on heat exchange and temperature distribution in an assembly.

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USSR UDC 621.039.5

YEGOROV, YU. A., YEREMIN, N. N. KOROTKOV, V. T., PAVLENKO, V. I., PAVLOV, S. D., SKLYAROV, V. P., TARASOV, A. I., KHANDAMIROV, YU. E., SHCHERBINA, V. G. and YASHNIKOV, A. I.

RADIATION MONITORING IN THE PERIOD OF POST-INSTALLATION BLOW-THROUGH OF THE STEAM LINES ON THE FIRST BLOCK OF THE LENINGRAD NUCLEAR POWER PLANT IMENI V. I. LENIN

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 192-194

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V753 by I. Skirko]

[Text] The paper gives data obtained during the process of bringing the reactor up to power and blowing out the steam lines. Radioactivity was monitored in the coolant of the main loop, the air blown through the reactor pile, the air discharged by the blower systems, and the liquid effluent passing through the sewer system into the gulf. The total β-activity of the enumerated media is determined as well as the isotopic composition of the active products, and express radiochemical analysis is done on radioactive iodine isotopes. It is found that the radiation environment is safe.
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USSR UDC 621.039.5

VESELKIN, A. P., KIRILLOV, V. B., NECHETA, M. YE. and NIKITIN, A. V.

COMPARISON OF THE RADIOACTIVE CONTAMINATION OF THE LOOPS OF NUCLEAR REACTORS WITH WATER COOLING AND WITH GAS COOLING

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 206-215

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V752 by I. Skirko]

[Text] A comparison was made of data from seven water-cooled reactors and three gas-cooled reactors. It is pointed out that there is practically no intrinsic activity of the coolant in gas-cooled reactors, and that the activity of corrosion products is very low compared with water-cooled reactors. A higher discharge of fission products into the loop can be allowed in reactors with gas coolant. The dose rate of γ-radiation on equipment with operation of water-cooled reactors is considerably greater than on the equipment of gas-cooled reactors. An emergency situation involving loss of integrity in the in-pile loop causes fewer accidents on gas-cooled reactors for equal discharge of fission fragments into the loop.

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USSR

VESELKIN, A. P., KIRILLOV, V. B., NECHETA, M. YE. and NIKITIN, A. V., RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES, No 1, Atomizdat, 1975 pp 206-215

It is anticipated that improvement of reactor design will result in a further sharp reduction in the overall radioactivity in the in-pile loop of gas-cooled reactors.

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USSR UDC 621.039.5

GLUSHCHENKO, A. I., ORLOV, YU. V. and TSYGANKOV, V. D.

INVESTIGATION OF NEUTRON AND γ-RADIATION FIELDS IN ROOMS OF THE THIRD BLOCK AT THE NOVOVORONEZHSK NUCLEAR POWER PLANT

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 222-237

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V751 by I. Skirko]

[Text] The paper discusses the results of measurements of the spectral distirbutions and dose rates of neutron and gamma emission in rooms of the third block of the Novovoronezhsk Nuclear Power Plant. The studies were done in a period of reactor operation on power levels of 50-100% of the rated output. Deviations from the design values are noted. The reasons for deviations are discussed as well as possible improvements in the calculating technique.

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USSR UDC 621.039.5

BADYAYEV, V. V., YEGOROV, YU. A. and PANKRAT'YEV, YU. V.

NEUTRON ENERGY DISTRIBUTION OVER A WIDE ENERGY BAND IN SOME REACTOR SHIELDING MATERIALS

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 121-126

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V748 by I. Skirko]

[Text] The paper reports the results of measurements of the space-energy distributions of neutrons in grade St.3 steel, titanium and ferroserpentinite concrete in the energy range from 10 eV to 1 MeV. The neutron spectra at energies below 0.5 MeV are discussed in detail.

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USSR UDC 621.039.5

BADYAYEV, V. V., GLUSHCHENKO, A. I., YEGOROV, YU. A., PAVLOV, S. D., PANKRAT'YEV, YU. V., KHANDAMIROV, YU. E. and SHCHERBINA, V. G.

SOME RESULTS OF AN EXPERIMENTAL CHECK OF THE SHIELDING OF THE RBM-K-1000 REACTOR

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 182-191

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V747 by I. Skirko]

[Text] Data are presented for a check of the reactor shielding at the Leningrad Nuclear Power Plant done during physical and power startups and as the plant was being brought up to the rated power level. The measurements were made with neutron and γ-ray dosimeters, thermal and fast neutron counters, and scintillation and gamma spectrometers. The dose rates of γ-radiation and neutrons were measured in the central zone of the reactor at a thermal power of 700, 1370, 1600 and 2600 MW. The paper also gives γ-ray dose rates in boxes, near the main equipment of the technological loop and also in some work rooms. It is concluded that the shielding reduces γ-ray and neutron dose rates to acceptable safety levels.
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USSR UDC 621.039.5

VESELKIN, A. P., POLUSHKINA, N. N., KHANDAMIROV, YU. E.

BIOLOGICAL SHIELDING OF THE RBM-K REACTOR

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 177-182

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V746 by I. Skirko]

[Text] The paper describes radiation shielding of the reactors installed at the Leningrad Nuclear Power Plant -- the pilot installation for the series of nuclear power plants being built in the USSR. Experimental studies of the radiation environment conducted during physiological and power startups, as well as during the course of subsequent operation, show that the shielding of the reactor ensures emission dose rates close to the design values.

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USSR UDC 621.039.5

MIRONOV, V. N., TSYPIN, S. G., IZ"YUROV, A. S. and RYMARENKO, A. I.

INVESTIGATION OF THE EFFECTIVENESS OF BIOLOGICAL SHIELDING IN NUCLEAR ELECTRIC POWER PLANTS WITH WATER-MODERATED WATER-COOLED POWER REACTOR

Moscow RADIATSIONNAYA BEZOPASNOST' I ZASHCHITA AES [Radiation Safety and Shielding of Nuclear Electric Power Plants, Collection of Works] in Russian No 1, Atomizdat, 1975 pp 237-243

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V745 by I. Skirko]

[Text] Shielding studies were done on water-moderated water-cooled power reactors at the Novovoronezhsk and Kola nuclear power plants. It is shown that the radiation environment is basically normal on units with the VVER-440 power reactors. For instance in constantly occupied rooms the overall dose rate does not exceed 1.4 millirems per hour. In occasionally occupied and unoccupied rooms the dose rate of γ-emission corresponds on the average to design values of 2.8 and 28 millirems per hour respectively. Various sections where the dose rates exceed the design values are indicated.

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USSR UDC 621.039.5

RATNIKOV, YE. F., DOKUCHAYEV, V. V. and KAMAYEV, V. A., Ural Polytechnical Institute

ON METHODS OF ANALYZING THE RADIATION ENVIRONMENT OF A NUCLEAR ELECTRIC POWER PLANT

Sverdlovsk O METODAKH ANALIZA RADIATSIONNOY OBSTANOVKI AES in Russian, 1976, 7 pp (manuscript deposited in VINITI 6 Feb 76 No 349-76 Dep.)

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V741DEP]

[Text] An examination is made of the possibility of a unified approach to analysis of the distribution of γ-quanta in a nuclear electric power plant. It is established that the distribution of γ-quanta can be analyzed by methods of electrostatic fields and newtonian potential theory. Simple and complex γ-quantum fields are described by the methods of field theory. Isodose characteristics are found. The possibility of analyzing the radiation environment of the power plant is established. References 6.

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USSR UDC 621.039.5

YEFIMENKO, V. F. and SHAPAR', A. V.

TIME-OF-FLIGHT METHOD FOR MEASURING THE NEUTRON SPECTRUM IN FAST CRITICAL ASSEMBLIES

Obninsk METOD VREMENI PROLETA DLYA IZMERENIYA SPEKTROV NEYTRONOV V BYSTRYKH KRITICHESKIKH SBORKAKH in Russian, Power Engineering Physics Institute, FEI-620, 1975, 22 pp, mimeo.

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V735 by the authors]

[Text] A procedure is described for measuring the soft part of the spectrum of a neutron beam coming from the fast critical assembly of a BFS [expansion not known]. Corrections are given to account for the way that the spectrum is influenced by the correlated background, the spectrometer resolution and the amount of material in the time-of-flight channel. An estimate is made of the errors of measurement of the neutron beam spectrum.

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USSR UDC 621.039.5

SAF'YER, D. and YIFTAKH, S.

INFLUENCE THAT HEAVY ISOTOPES OF PLUTONIUM HAVE ON THE DYNAMIC CHARACTERISTICS OF FAST REACTORS. NEW DATA ON DELAYED NEUTRONS

Moscow MATERIALY MEZHDUNARODNOGO SIMPOZIUMA PO FIZIKE BYSTRYKH REAKTOROV [Materials of the International Symposium on Fast Reactor Physics] in Russian No 6, Atomizdat, 1975 pp 48-57

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V714 by B. Kebadze]

[Text] A comparative analysis is made of kinetic parameters and space-time behavior of fast neutrons of different configurations. The main emphasis is placed on the following questions: a) difference in deviations of power in transient modes in reactors based on pure ^{239}Pu and with different concentrations of ^{240}Pu, ^{241}Pu and ^{242}Pu; b) comparison of dynamic characteristics when new estimated data and the data from the ENDF/B-3 library are used; c) difference in dynamics for old and new data on delayed neutrons. An examination was made of a four-group nonstationary diffusion equation in one-dimensional geometry (infinite plate) with correction on the laplacian

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USSR

SAF'YER, D. and YIFTAKH, S., MATERIALY MEZHDUNARODNOGO SIMPOZIUMA PO FIZIKE BYSTRYKH REAKTOROV, No 6, Atomizdat, 1975 pp 48-57

for other measurements. An examination is made of prototype reactors of the "Phoenix" type, and a reactor with power of 1000 MWe. In large systems the lifetime of prompt neutrons increases by 20% with removal of heavy plutonium isotopes. β_{eff} decreases. In transient modes the new data give a more than 20% increase in the power of a large reactor as compared with the ENDF/B-3 data. An increase in the fraction of delayed ^{238}U neutrons by 10% increases β_{eff} by 3-6%. Some measurements give an even greater discrepancy with the data of Kipin (up to 17%) on the yield of delayed ^{238}U neutrons. The need for more detailed measurements is emphasized.

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USSR UDC 621.039.5

ZEMSKOV, YE. A.

AN ALGORITHM FOR SYNTHESIZING SOLUTIONS OF A SYSTEM OF DIFFUSION EQUATIONS FOR A THREE-DIMENSIONAL REACTOR WITH A SCRAM ROD SYSTEM

Obninsk ALGORITM SINTEZA RESHENIY SISTEMY DIFFUZIONNYKH URAVNENIY TREKHMERNOGO REAKTORA S SISTEMOY POGLOSHCHAYUSHCHIKH STERZHNEY in Russian, Engineering Physics Institute, FEI-551, 1975, 20 pp mimeo.

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V700]

[Text] A solution in (r,ϕ,z) geometry is constructed by the method of synthesis from the (r,ϕ) eigenfunctions for each layer of a reactor that contains scram rods. The coefficients of the expansion of the solution with respect to basis functions are determined by the Bubnov-Galerkin method utilizing the concept of generalized differentiation.

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USSR

BAKANOV, L. V., ERMAKOV, K. N., LEBEDEV, V. D., MIROSHKIN, V. V., PASHUK, V. V., STABNIKOV, M. V., and TVERSKOY, M. G., B. P. Konstantinov Institute of Nuclear Physics, Academy of Sciences USSR

AN APPARATUS FOR STUDYING MULTIPARTICLE NUCLEAR SPALLATIONS

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 5, Sep 76 pp 320-323 manuscript received 28 Jul 76

[Abstract] The new apparatus developed for studying multiparticle nuclear fission by the photoemulsion method consists, essentially, of a hybrid gas-liquid chamber inside an electromagnet system. The chamber is filled with liquid (Freon mixture) and contains a gaseous (Ar^{40}) target inside a cylinder. An expandor with a recompressor is mounted on the chamber base. All parts are made of grade 1Kh18N10T stainless steel. A proton beam about 1.0 cm in diameter and with an energy of 1.0 GeV is formed by a system of magnetic lenses and collimators, passes through a window in the chamber, and the number of particles passing through the chamber is then recorded by two magnetically shielded scintillation counters. Photographs are taken through a model T-2c Russar-Plasmat objective. Programmed electronic circuits control the servomechanisms operating this apparatus and synchronize its components with the synchrocyclotron system. References 2 Russian.
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USSR

DEMIDOV, A. M., and GOVOR, L. I., Institute of Atomic Energy imeni I. V. Kurchatov

DE-EXCITATION OF 2_2^+ LEVELS IN EVEN-EVEN MASS NUCLEI WITH $60<A<150$ AND $190<A<220$

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 4, 1976 pp 250-253 manuscript received 9 Jul 76

[Russian abstract provided by the source]

[Text] The suggestion is set forth of a relationship between the mixture and phase ratio of M1 and E2 radiation in $2_2^+ - 2_1^+$ transitions with different degrees of hardness of the proton and neutron system in spherical even-even mass nuclei. A correlation is found between the ratio $B(E2,2_2^+ \rightarrow 0_0):B(E2,2_2^+ - 2_1^+)$ and the energy difference of levels $E(0_1^+)-E(2_2^+)$. References 4: 1 Russian, 3 Western.

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USSR

PARAIL, V. V., Institute of Atomic Energy imeni I. V. Kurchatov

ANOMALOUS IMPEDANCE WITH HIGH FREQUENCY HEATING OF A TOKAMAK PLASMA

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 24, No 4, 1976 pp 199-202 manuscript received 18 Jun 76

[Abstract] Solution of a system of equations describing induced scattering of electromagnetic waves by ions in an isothermal plasma with rf heating in a tokamak configuration shows that longitudinal current in the plasma interacts with induced scattering to produce Langmuir oscillations with mean longitudinal momentum opposed to the electron momentum. As these waves interact with the electrons, they transmit their own energy and momentum to the electrons and thus reduce the longitudinal current, which should be experimentally observable as anomalous impedance. Expressions are derived that give a self-consistent description of electron deceleration in this system for the limiting case of strong eddy currents where the scattering process shows pronounced asymmetry. A condition is given for symmetrizing the scattered waves. The described mechanism can be used to prevent skinning of the vortex current in large tokamaks. References 4: 3 Russian, 1 Western.
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BOGOLYUBSKIY, S. L., GERASIMOV, B. P., LIKSONOV, V. I., POPOV, YU. P., RUDAKOV, L. I., SAMARSKIY, A. A., SMIRNOV, V. P. and URUTSKOYEV, L. I., Institute of Atomic Energy imeni I. V. Kurchatov

HEATING OF THIN FOILS BY A HIGH-CURRENT ELECTRON BEAM

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 24, No 4, 1976 pp 202-206 manuscript received 1 Jul 76

[Abstract] When thin anodized foils (10-30 μm gold) are bombarded with a focused beam of relativistic electrons, an anomalously high heating of the foils is observed, an order of magnitude greater than the energy contribution calculated in the one-particle approximation. The effect observed is explained by an increase in the time which the electrons spend in the plasma of the foil due to the action of the magnetic field of a high-current diode. The effect of anomalously high absorption of energy of the beam in the thin foils provides an energy contribution of up to 80 eV per gold atom and allows modeling of the heating of thermonuclear targets. References 4 Russian.

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USSR UDC 621[.039.61+.378.325]

PROKHOROV, A. M., ANISIMOV, S. I., and PASHININ, P. P., Physics Institute, imeni P. N. Lebedev Academy of Sciences USSR

LASER-DRIVEN THERMONUCLEAR FUSION

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 119, No 3, Jul 76 pp 401-424

[Russian abstract provided by the source]

[Text] A state-of-the-art survey of theoretical and experimental research in the area of laser-driven thermonuclear fusion. An examination is made of an extensive class of physical problems in the field of laser-driven fusion, as well as the directions being taken in solving them. Emphasis is being placed on such urgent problems as the energy processes of laser-driven fusion, adiabatic target implosion, conditions of development of hydrodynamic instabilities, plasma absorption of laser emission and plasma heating. A detailed analysis is made of the results of numerical modeling of laser-driven thermonuclear fusion as found with different initial assumptions regarding the type of target, laser pulse parameters and the dominating processes in the laser plasma. Some results are given on experimental research in laser-driven fusion in recent years. References 94: 43 Russian, 51 Western.
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USSR

BOGOLYUBSKIY, S. L., GERASIMOV, B. P., LIKSONOV, V. I., MIKHAYLOV, A. P., POPOV, YU. P., RUDAKOV, L. I., SAMARSKIY, A. A., and SMIRNOV, V. P., Institute of Atomic Energy imeni J. V. Kimchatov

YIELD OF THERMONUCLEAR NEUTRONS FROM A SHELL-IMPLODED PLASMA

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 4, 1976 pp 206-209 manuscript received 1 Jul 76

[Russian abstract provided by the source]

[Text] A polyethylene piston 10 μm thick, accelerated by a relativistic eledron beam to a velocity of $5\text{-}7\cdot10^6$cm/s implodes a deuterium plasma in a lead cone by a thousand times to a density of 10^{22}cm^{-3} and heats it to a temperature of 1 KeV. According to calculations, thermonuclear neutrons are recorded in a quantity of $1\text{-}3\cdot10^6$ per pulse.

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USSR

VOLOSEVICH, P. P., GAMALIY, YE. G., GULIN, A. V., ROZANOV, V. B., SAMARSKIY, A. A., TYURINA, N. N. and FAVORSKIY, A. P., Institute of Applied Mathematics, Academy of Sciences USSR

TWO-DIMENSIONAL EFFECTS ACCOMPANYING LASER IMPLOSION OF GLASS SHELLS

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24, No 5, 5 Sep 76 pp 283-286 manuscript received 20 Jul 76

[Abstract] The authors discuss the results of two-dimensional calculations on determining the influence that different types of perturbations in the initial conditions have on the stability of laser-driven implosion of glass shell targets with parameters corresponding to an experimental case. A solution is found for a system of equations that describe axisymmetric hydrodynamic flows with electronic thermal conductivity. Provision is made for introducing an equation of the state of matter with consideration of "cold" implosion, effects of electron degeneracy, nonuniform ionization, electron-ion relaxation and some other physical effects. The technique for numerical solution is based on divergent difference schemes such that the basic laws of conservation that are true for systems of differential equations can be carried over to their discrete analogs. The main purpose of the calculations

is to determine the influence that deviations from flow uniformity and variations in shell shape at time zero have on the plasma parameters of the target in the final stage of implosion. It was found that perturbations on the acceleration stage develop more slowly than on the stage of deceleration of matter close to the center for perturbation amplitudes up to 5%. Flow perturbations typically lead to lower amplitudes on the final stage than shape perturbations of the same relative magnitude, showing some equalization of thermal conductivity, although it is so weak that flow perturbations as low as 1-5% distort the shape of the shell. Perturbations develop most strongly on the final stage of deceleration. The linear phase of development becomes nonlinear and a jet begins to form. This situation holds for both types of perturbations. However, deviations from the one-dimensional case are slight for the given range of parameters. Perturbations greater than 10% in amplitude could result in a significantly nonspherical final shape of the target, and in this case the results of a two-dimensional calculation might be useful for predicting the integral emission pattern in x-rays, and comparing the predicted pattern with experiment. References 6: 5 Russian, 1 Western.

USSR UDC 539.12.18:539.126.34

GORDEYEV, V. A., GRIDNEV, A. B., KOPTEV, V. P., KRUGLOV, S. P., KUZ'MIN, L. A., and LOPATIN, I. V.

THE π-MESON CHANNEL OF THE LINP SYNCHROCYCLOTRON

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 76 pp 25-26
manuscript received 25 Mar 75

[Abstract] A description is presented of the design and characteristics of the π-meson channel of the synchrocyclotron of the Leningrad Institute of Nuclear Physics, Academy of Sciences USSR, created for programs of investigation of pion-nucleon interactions in the range of energies up to 700 MeV. With a proton flux to the meson-forming target of $5 \cdot 10^{11}$ p/s, the channel allows up to 10^5 π-mesons with an energy of 490 MeV to be focused onto an area of 10 x 10 cm^2 with a pulse dispersion $\Delta p/p$ of 0.06. The divergence of the beam is not over 1°. The experimental data are compared with the results of calculations. The beam of mesons produced by the 30 cm-thick polyethylene target is cleansed of protons in a plexiglas filter, after passing through which the protons and π-mesons have different momenta, so that they can be separated by

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USSR

GORDEYEV, V. A., GRIDNEV, A. B., KOPTEV, V. P., KRUGLOV, S. P., KUZ'MIN, L. A., and LOPATIN, I. V., PRIBORY I TEKHNIKA EKSPERIMENTA No 2, Mar/Apr 76 pp 25-26

an SP-57 magnet. This reduces the quantity of protons present to 15% at a π-meson energy of 450 MeV. The number of muons and positrons present is not over 5%. The π-meson channel has already been used to measure polarization and differential cross sections in elastic πp scattering in the 290-450 MeV range. References 4: 3 Russian, 2 Western.

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USSR

GORELIK, V. S., IVANOVA, S. V., KUCHERUK, I. P., STRUKOV, B. A. and KHALEZOV, A. A., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, Moscow

TEMPERATURE DEPENDENCE OF RAMAN SPECTRA IN $LiNbO_3$

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2297-2300
manuscript received 5 Apr 76

[Russian abstract provided by the source]

[Text] Raman spectra in a ferroelectric crystal of lithium niobate are obtained in the temperature range of 80-1220 K. The spectra were stimulated by the emission line on $\lambda = 5145$ Å from an argon laser, and were recorded by the DFS-12 double monochromator for the scattering geometry $x\,(zz)\,y$. The resultant maxima of Raman frequencies were used to calculate permittivity along the crystallographic axis ε'_{0z} by using the Lindan-Sachs-Töpler (LST) relation. A comparison of the temperature dependence $\varepsilon'_{0z}(T)$ found in a direct way with the results of the calculation shows that the LST relation is satisfied only at low temperatures. It is also shown that this temperature behavior is satisfactorily explained on the basis of permittivity calculations by the Kramers-Kronig formula. References 9: 7 Russian, 2 Western.
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USSR

UDC 533.9.004.14

BATENIN, V. M. and MINTSEV, P. V.

HIGH-INTENSITY SOURCES OF EMISSION

Moscow KHIMIYA PLAZMY [Plasma Chemistry, Collection of Works] in Russian No 2, Atomizdat, 1975 pp 199-244

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5G329 by Yu. Levitan]

[Text] The survey deals with plasma electrode sources of intense incoherent emission, and also with some other methods of producing intense emission. The authors point out the design particulars of different modifications of sources, methods of producing and stabilizing the plasma, plasma parameters and brightness characteristics of sources. The direction of development is determined chiefly by two interrelated problems: achievement of high brightnesses and producing intense luminous fluxes. The authors feel that there is still room for alternatives in the problem of developing a source of blackbody radiation in the visible region of the spectrum, although brightness temperatures of 10 000-12 000 K have already been attained. Particular attention is given to long arcs with emission takeoff from the lateral

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USSR

BATENIN, V. M. and MINTSEV, P. V., KHIMIYA PLAZMY, No 2, Atomizdat, 1975 pp 199-244

surface and low losses of radiation to the electrodes. Light fluxes of high intensity can be achieved in such sources by using heavy inert monatomic gases. The authors demonstrate the clear advantages of plasma radiation sources, especially in the ultraviolet region of the spectrum. References 105.

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USSR UDC 551.573

BOTYGINA, N. N., BUKATYY, V. I., and KHMELEVTSOV, S. S., Institute of Atmospheric Optics, Siberian Division, Academy of Sciences USSR

INVESTIGATION OF TRANSPARENCY OF WATER UNDER LASER RADIATION

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY FIZIKA in Russian No 7, 1976 pp 29-32 manuscript received 31 Dec 75

[Abstract] The authors present the results of measuring the transparency of water under the action of pulsed laser radiation, and they analyze the various factors affecting the laws of light diffusion in the liquid studied. A neodymium laser with a radiation wavelength of 1.06 μm operating in the mode of free emission with a pulse duration of 10^{-3}s was used in the experiments. Radiation was focused by a lens having a focal length of 75 cm. Distilled water with an electrical conductivity $\sim 10^{-5} \Omega^{-1} cm^{-1}$ was used in the experiments. Special precautions were taken to lessen the possibility of any particles of dust falling into the irradiated area. It was found that at energy densities $W < 350$ J/cm^{-2} the transparency of water does not depend on the energy density and corresponds to the transparency measured on the spectrometer. But at $W \approx 350$ J/cm^2 a

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USSR

BOTYGINA, N. N., BUKATYY, V. I., and KHMELEVTSOV, S. S., IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY FIZIKA No 7, 1976 pp 29-32

deviation from the laws of linear optics was observed that could be due to the following causes: (a) dependence of the absorption coefficient of water on temperature as a result of pulsed heating; (b) variation of the geometry of the beam as a consequence of radiation defocusing by the induced transverse profile of the index of refraction of the medium; (c) diffraction of light by the chaotic sequence of sound waves due to the peak mode of radiation; (d) nonlinear scattering by the action of minute gas bubbles formed in the process.

The influence of each of these mechanisms on the dynamics of transparency is examined, and it is shown that the principal cause of induced scattering is the formation of bubbles on absorbing centers remaining in the water even after double distillation. These microparticles are heated by laser action, resulting in vapor formation that causes scattering halation. References 14 Russian.

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USSR UDC 535.33:621.375.8;535.530.182;778.38

YEREMENKO, A. S., ZAYTSEV, V. K., MALININ, B. G., STEPANOV, A. I., KHAZOV, L. D. and SHANICHEV, G. YA.

INSTRUMENT FOR CHECKING THE RADIATION STRENGTH OF LASER OPTICAL ELEMENTS

OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, 1976 pp 30-32

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1303 by the authors]

[Text] The authors describe the IT-181 instrument for checking the radiation strength designed for production monitoring of the radiation strength and lifetime of the working surfaces of laser optical elements in the technical monitoring shops of optico-mechanical plants, and also for quality control of finishing and special machinery of the optical surfaces. Measurement of radiation strength is accomplished by a special method. The basic technical characteristics of the instrument are given.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

DERYUTIN, I. A. and KURASHOV, V. N.

INTERFEROMETRIC METHOD OF RECORDING AND RECONSTRUCTING IMAGES IN OPTICS

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 83-101

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1337]

[Text] The authors examine methods of optical reconstruction of images of an object according to measurements of the autocorrelation function of radiation in the remote zone, based on applications of exponential filtration of the signal used and an incoherent reference source. They give an analysis of the possibilities of using intensity interferograms for these purposes. They give evaluations of the distortions in the reconstructed image associated with nonmonochromaticity of the source.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

VANIN, V. A. and VAGIN, L. N.

COPYING OF HOLOGRAMS

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 225-243

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1346 by M. M. Yermolayev]

[Text] The authors give a comparison of the various methods of copying holograms. They determine the influence that the type of original hologram, the gap between the hologram and the copying material, the wave shape and wavelength of light of the reconstruction wave front have on the properties of the copy. They give optical arrangements and results of experiments. References 22.

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USSR UDC 535.33:621.375.8;535.530.182;778.38

BYKOVSKIY, YU. A., YELKHOV, V. A. and LARKIN, A. I.

SEMICONDUCTOR LASER AS A SOURCE OF RADIATION FOR HOLOGRAPHIC EXPERIMENTS AND INSTRUMENTS

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 260-270

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1349]

[Text] The authors give the theoretical and experimental results of an investigation of the coherent properties of radiation of injection semiconductor lasers. They show the possibility of using injection lasers for recording holograms, holographic interferometry, mono-pulse holograph and information readout with a storage density of 10^5 bits/mm^2.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

BARACHEVSKIY, V. A. and KOZENKOV, V. M.

STATE AND PROSPECTS OF DEVELOPING NONSILVER AND UNUSUAL RECORDING MEDIA FOR HOLOGRAPHY

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 502-503

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1350]

[Text] The authors give a survey of the holographic characteristics of reversible (organic and inorganic photochromic materials, electro-optical crystals, photothermoplastic systems, absorbing liquids and semiconductor crystals, chalcogenide films and glasses) and irreversible (photopolymers, acid resists, chromated gelatin films, dizao type materials, semiconductor-metal systems, metal films) recording for holography. They examine the prospects of improvement and the possibilities of using these materials in holography.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

KOZENKOV, V. M., BARACHEVSKIY, B. A. and GAPONENKO, I. YE.

IRREVERSIBLE ORGANIC LIGHT-SENSITIVE MEDIA FOR HOLOGRAPHY

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 455-495

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1351]

[Text] This is a survey of the methods of preparation, properties and processes of formation of holograms in several of the most well-developed organic recording materials (acid resists, photopolymers, free radical systems). They give experimental data on several of the most important holographic parameters, such as the modulation transfer function and the diffraction efficiency.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

RYABOVA, R. V.

NEW PHOTOGRAPHIC MATERIALS FOR HOLOGRAPHY

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials on the Seventh All-Union School on Holography] in Russian 1975 pp 325-329

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1352]

[Text] The author lists new photographic materials for recording laser emission in the 0.69 μm, 0.84 μm and 1.06 μm band and gives brief characteristics of their properties.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

ROVINSKAYA, YU. I., GAFUROVA, N. S., BORIN, A. V. and MIKHEYEVA, V. P.

HOLOGRAPHIC FILM FP-GV2 AND ITS PROCESSING

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 321-323

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1353]

[Text] The authors cite data on the photographic properties of a new holographic film the FP-GV2 and on the method of processing to maximize diffraction efficiency.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

KUVSHINSKIY, N. G., BAZHENOV, M. YU. and SOKOLOV, N. I.

HOLOGRAPHIC RECORDING ON THERMOPLASTIC MEDIA

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 354-381

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1360 by M. M. Yermolayev]

[Text] The authors examine the sensitometric properties of holographic TPR materials and show that they may be used in the entire visible and near IR regions of the spectrum. References 18.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

BERDONOSOV, V. A., GORBUNOV, V. I. and STOYANOV, A. K.

HOLOGRAPHIC SYNTHESIS OF THREE-DIMENSIONAL X-RAY IMAGES

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 178-188

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1366]

[Text] The authors suggest a theoretical model of holographic synthesis of three-dimensional x-ray images. On the basis of the model they demonstrate that under certain conditions of synthesis a virtual image component is equivalent to a field of radiating sources with a distribution density proportional to the density of the material of the object. The computed properties of ideally synthesized images coincide with the experimental ones.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

VLASOV, N. G. and SHTAN'KO, A. YE.

CONTEMPORARY STATE AND PROBLEMS OF HOLOGRAPHIC INTEFEROMETRY

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 191-211

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1371 by M. M. Yermolayev]

[Text] The authors compare the classical and holographic methods of interferometry. They describe a new trend in holographic interferometry based on the correlation of intensity of diffusely coherent radiation. References 38.

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USSR UDC 535.33:621.375.8;535:530.182;778.38

VLASOV, N. G. and SHTAN'KO, A. YE.

EVALUATION OF THE MEASUREMENT ERRORS IN HOLOGRAPHIC INTERFEROMETRY OF REFLECTING OBJECTS

Leningrad MATERIALY SED'MOY VSESOYUZNOY SHKOLY PO GOLOGRAFII [Materials of the Seventh All-Union School on Holography] in Russian 1975 pp 212-222

[From REFERATIVNYY ZHURNAL, FIZIKA No 6(1) 1976 Abstract No 6D1373 by M. M. Yermolayev]

[Text] The authors make an analysis of the errors in holographic interferometric methods of measuring shifts in the surface of diffusely reflecting objects. They give the methods of taking these errors into account. The premises are illustrated by a specific example. References 6.

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USSR UDC 535.853.4

FABELINSKIY, I. L., and CHISTYY, I. L., Physics Institute, imeni P. N. Lebedev Academy of Sciences USSR

NEW TECHNIQUES AND ADVANCES IN HIGH RESOLUTION SPECTROSCOPY

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 119 No 3, Jul 76 pp 487-524

[Russian abstract provided by the source]

[Text] The theoretical principles of the method of utilization of multi-pass Fabry-Perot interferometers and an iodine light filter for the production of high contrast spectra are presented. A planar Fabry-Perot interferometer with two, three and five successive passages of light through the device, as well as one and two-pass spherical Fabry-Perot interferometers and series hookups of both types are studied. Examples of experimental investigation of molecular scattering spectra of light with phase transitions in imperfect and liquid crystals, pressed powders, opaque crystals as well as spectra of acoustical magnons are presented. The resultant contrast of the spectra reaches 10^{12} when multipass and tandem interferometers are used and 10^5 when an iodide light filter is used. References 68: 17 Russian, 50 Western.
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USSR UDC 533.9.082

KOLOBOVA, G. A., and MEL'NIKOVA, T. S., Institute of Thermal Physics, Academy of Sciences USSR, Novosibirsk

DIAGNOSIS OF AN ABSORBING PLASMA FROM THE CONTINUOUS SPECTRUM

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 8(2), 1976 pp 19-22 manuscript received 4 Oct 74

[Russian abstract provided by the source]

[Text] An iterative method is suggested for diagnosis of an absorbing plasma based on absolute values of the intensity of the continuum, measured in the cross-section of an axisymmetric source, assuming local thermodynamic equilibrium. Results are presented from calculation of the distribution of temperature and composition of a dc argon arc at pressures of 1 and 3 atm with various values of arc current. References 10: 6 Russian, 4 Western.

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USSR UDC 535.8

GRASYUK, A. Z., YEFIMKOV, V. F., and SMIRNOV, V. G., Physics Institute, Academy of Sciences USSR, Moscow

A FOCUSING PRISM RASTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan/Feb 76 pp 174-175 manuscript received 25 Feb 75

[Abstract] A description is presented of a prism raster--a raster focusing device allowing laser radiation to be collected into a spot of assigned size with homogeneous distribution of intensity within the spot. The dimensions of the spot at the half intensity level are independent of the divergence of the beam being focused, as well as the distribution of intensity over its cross section. The raster focusing device consists of two crossed sets of wedges. The profile of each set represents a portion of a polygon inscribed in a circle. The two sets taken together form a set of prisms--a prism raster. Drawings and a photograph of the device are presented. References 1 Russian.

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USSR

ARONOV, A. G., ZELIKMAN, M. A. and SPIVAK, B. Z.

NONEQUILIBRIUM EXCITATIONS IN SUPERCONDUCTORS, AND PHONON FLUORESCENCE

Leningrad FIZIKA TVERDOGO TELA in Russian Vol 18, No 8, Aug 76 pp 2209-2216
manuscript received 19 Mar 76

[Abstract] An investigation is made of nonequilibrium distributions of phonons and quasi-particles for superconductive films with thicknesses intermediate between the mean free path of phonons with energies of the order of 2Δ or less and those with energies of the order of 2Δ or more at temperatures much less than Δ. The distribution functions are calculated for both optical and microwave pumping. The peculiarities of the phonon emission spectrum are discussed. In the case of microwave pumping, the effective temperature of quasi-particles and phonons with energies higher than 2Δ may decrease at sufficiently high intensities. For weak pumping the concentration of excitations varies as the square root of emission intensity, and for strong pumping the concentration is proportional to intensity. References 16: 8 Russian, 8 Western.

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USSR

VERESHCHAGIN, L. F., SAVITSKIY, YE. M., YEVDOKIMOVA, V. V., NOVOKSHENOV, V. I., and PETRENKO, V. G., Institute of High Pressure Physics, Institute of Metallurgy, Academy of Sciences USSR

INFLUENCE OF HIGH PRESSURES AND TEMPERATURES ON THE SUPERCONDUCTING PROPERTIES OF Nb_3Ge WITH A-15 TYPE STRUCTURE

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24 No 4, 1976 pp 218-219 manuscript received 8 Jul 76

[Abstract] An attempt was made to synthesize and process the compound Nb_3Ge with A-15 structure under the influence of high pressures and temperatures in the 50-90 bar and 1200-2000°C interval respectively. In all cases when the compound was synthesized, its T_c did not fall below 11 K, the maximum values of superconducting transition temperature were produced in specimens synthesized at 70 bar, 1400°C, 5 minutes and 70 bar, 2000°C, 1 minute: 19.4 and 19.1 K respectively. Processing of the alloy niobium +25 at .% germanium with the addition of the second component led to an increase in the value of T_c from 6.1 K for the initial component Nb_3Ge to 19.5-19.7 K for specimens subjected to pressures of 70-90 bar at 2000°C for 15-30 s. References 2 Russian.

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USSR

PRON'KO, G. P., and STROGANOV, YU. G., Institute of High Energy Physics

A NEW EXAMPLE OF A QUANTUM MECHANICAL PROBLEM WITH LATENT SYMMETRY

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 24 No 4, 1976 pp 196-199 manuscript received 11 Jun 76

[Abstract] Studying the problem in which the internal degrees of freedom interact with a heterogeneous field, the authors discovered an example of such a system having dynamic symmetry. Namely, a neutron in the magnetic field of a linear current forms bound states with spectrum defined by dynamic symmetry group O (3). The analysis is based on solution of the Schrödinger equation for a neutral nonrelativistic particle with spin 1/2. The wave functions of the discrete spectrum are found in the pulse representation in dimensionless form for a system with external magnetic field created by linear longitudinal current. It is shown that there is a direct relation between the hamiltonian for this system and the generators of dynamic symmetry group O(3). For problems with latent symmetry, the so-called noninvariance group is frequently introduced, one of the irreducible representations of which describes all

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PRON'KO, G. P., and STROGANOV, YU. G., PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI No 4, 1976 pp 196-199

bound states of the system. The authors state that they have found such a group that is in isomorphic correspondence with the complex form of group O(5) for a modified "hamiltonian" having a linear spectrum and wave functions corresponding to those of the initial hamiltonian. References 3: 2 Russian, 1 Western.

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USSR

GETMANOV, B. S., Joint Institute of Nuclear Research

BOUND STATES OF SOLITONS IN THE ϕ_2^4 MODEL OF FIELD THEORY

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 24 No 5, Sep 76 pp 323-327 manuscript received 2 Aug 76

[Abstract] Numerical experiments have revealed a quasisteady bound state of three solitons (a "triton"). This state is described here analytically in terms of the Higgs equation of motion and its exact local solution with quasiparticle characteristics. Attraction between solitons of different signs results in an emission of excess energy in the form of waves with a small amplitude and, at a certain relation between the velocities, in an oscillating bound state. A triton is found to have a rather long life, but not as long as that of a bion (two bound solitons). The dynamic behavior of both is very regular, according to analytically derived equations. The same method of analysis has also revealed a bound state of solitons of the nonlinear Klein-Gordon equation, later confirmed by numerical experiments. Already on the

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GETMANOV, B. S., PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI
No 5, Sep 76 pp 323-327

classical level, therefore, the equations of the ϕ_2^4 model apparently have a broad spectrum of quasiparticle solutions with nontrivial dynamics. References 3 Russian.

USSR UDC: 621.039.5

PLYASHKEVICH, V. YU.

A VARIATIONAL METHOD OF SOLVING KINETIC EQUATIONS IN PERIODIC LATTICES

Moscow VARIATSIONNYY METOD RESHENIYA KINETICHESKIKH URAVNENIY V PERIODICHESKIKH RESHETKAKH in Russian, Institute of Atomic Energy imeni I. V. Kurchatov, IAE-2549, 1975, 24 pp, mimeo.

[From REFERATIVNYY ZHURNAL, FIZIKA No 5, 1976 Abstract No 5V701K by B. Kebadze]

[Text] A variational method is outlined for solving the problem of neutron transport in periodic non-breeding lattices without air gaps or cavities in the one-velocity kinetic approximation with consideration of anisotropy of scattering and the neutron source. The variational problem is formulated for a kinetic equation in self-adjoint form and solved approximately by the Galerkin method in which the trial functions depend on angular and spatial variables. The coefficients in the expansion of the approximate solution are assumed to be dependent on the angular variables. In contrast to the classical Galerkin method and the method of spherical harmonics, the proposed technique takes better consideration of the angle dependence of the

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PLYASHKEVICH, V. YU., VARIATSIONNYY METOD RESHENIYA KINETICHESKIKH URAVNENIY V PERIODICHESKIKH RESHETKAKH, IAE-2549, 1975, 24 pp

neutron flux. The stability and convergence of the method are proved. The analytical form of the angular distribution of neutron flux is found in the fixed cross section approximation for linearly anisotropic scattering. An examination is made of the problem of optimum choice of trial functions. Asymptotic estimates are given for the error of the approximate solution of the problem.

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